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DESIGNING Accessways

California Coastal Commission

E Report - Coastal Access Standards Element of the California Recreation Plan

A Joint Publication of the California Coastal Commission and the State Coastal Conservancy

COASTAL ACCESS STANDARDS ELEMENT

of the

CALIFORNIA RECREATION PLAN

A Joint Publication of

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Introduction

Coastal access means getting to and using California's shoreline. Fulfilling the public's right to coastal access, guaranteed by the State's constitution and endorsed by the passage of the Coastal Initiative in 1972 as well as the Coastal Act and Conservancy Act of 1976, means more than just setting aside areas for public use. It means providing adequate and easily accessible facilities which are economical to maintain and keep open. As the State's agencies responsible for providing coastal access, the Coastal Commission and Coastal Conservancy work with local governments, state agencies, private organizations, and individuals in designing, funding, and constructing access facilities.

This manual has been prepared as a detailed reference source for local governments, private organizations, and individuals. It will also provide assistance to local nonprofit organizations, such as land trusts, which are undertaking an increasingly important role in coastal resource development and management. It provides an introduction to the development of coastal access facilities, giving recommended dimensions, designs, and important criteria for construction and maintenance. For those already experienced with access development, it provides new design ideas and current cost information.

The first chapter reprints the Coastal Access Standards, which were adopted by the Coastal Commission and Coastal Conservancy in 1980 and 1981 as part of the agencies' joint Coastal Access Program. The Standards are a guide for the Commission's regulatory actions, the Conservancy's Access Grant Program, local governments' implementation of Local Coastal Programs, and state and federal agencies efforts to provide coastal access. The Standards apply to the location and establishment of access rights-of-way. Subsequent chapters provide information necessary for development of facilities on these rights-of-way.

The second chapter, Critical Factors in Accessway Design, highlights problems such as shoreline erosion, bluff and slope erosion, and vandalism, as they relate to the design of coastal access facilities. This manual suggests preventative measures that can be incorporated into the design of accessways to help minimize possible storm and vandal damage. This manual also describes requirements for providing access for the disabled.

The third chapter, Design Guidelines, gives guidelines, dimensions and specific facility design criteria for facilities such as stairways, trails, walkways, ramps, footbridges, boardwalks, and support facilities. After appropriate sections, case studies of selected access projects describe built facilities and their design details, costs and materials.

Although other design manuals for recreational facilities exist, this is the first attempt to deal specifically with coastal access facilities. The information presented here has been compiled from many sources, including other design manuals, the expertise of Commission and Conservancy staffs, and the experiences, both successful and unsuccessful, of people who have developed coastal accessways. The recommendations, designs, and ideas contained in this manual should help provide information and guidance for planning and constructing the economical, imaginative, and practical public access facilities that need to be built along California's shoreline.

Chapter 1

COASTAL ACCESS STANDARDS

STANDARDS for ACCESSWAY LOCATION and DEVELOPMENT

These standards provide overall guidance for the location, size and nature of access rights-of-way along the California Coast. They were adopted by the Commission and Conservancy to ensure a consistent approach is used to establish accessways. Because sites and circumstances vary along the coast, application of these standards must be flexible. For example, where existing development patterns have precluded precise adherence to the recommended standards, successful access to the shoreline has been provided on easements smaller than those recommended.

These standards apply to all new developments on currently undeveloped shorefront land, the infilling of existing developed shorefront areas, and the redevelopment of existing developed shorefront areas.

It is important to note the difference between the Standards and the Design Guidelines. The Standards apply to the actual right-of-way designations, dedications, and easements on both public and private land. These rights-of-way are the accessways. The Design Guidelines provide recommendations for facilities for the accessways. The type of facility needed for an accessway is dependent on the site, the amount of use, and other site-specific criteria.

GENERAL STANDARDS

Standard No. 1

Coastal access facilities should be located where they safely accommodate public use, and should be distributed throughout an area to prevent crowding, parking congestion, and misuse of coastal resources. Accessways and trails should be sited and designed: (a) to minimize alteration of natural landforms, conform to the existing contours of the land, and be subordinate to the character of their setting; (b) to prevent unwarranted hazards to the land and public safety; (c) to provide for the privacy of adjoining residences and to minimize conflicts with adjacent or nearby established uses; (d) to be consistent with military security needs; (e) to prevent misuse of environmentally sensitive habitat areas; and (f) to ensure that agriculture will not be adversely affected.

Standard No. 2

Coastal accessways located in areas of high fire or erosion hazard should be managed and constructed in a manner that does not increase the hazard potential. Access facilities on productive agricultural lands or timberlands can be temporarily closed during harvest or pesticide application times. Where appropriate, coastal accessways should be designed to correct abuses resulting from existing use.

Standard No. 3

Access facilities constructed on access easements should be no wider than necessary to accommodate the numbers and types of users that can reasonably be expected. Width of accessway facilities can vary from a minimum of 30 inches for a trail to a maximum of 10 feet or wider for ramps or paved walkways, depending on factors such as topography and proximity of the accessway to developed areas or major support facilities. Wherever possible, appropriate wheelchair access to the shoreline should be provided. Recommended widths, clearances, gradients, surfaces, and other related design criteria for various access facilities are discussed in Chapter Three, Design Guidelines.

Standard No. 4

The design and placement of accessways should fully provide for the privacy of adjoining residences. Each vertical access easement in a residential area should be sufficiently wide to permit the placement of an appropriate accessway facility such as a stairway, ramp, trail and fencing and/or landscape buffer as necessary to ensure privacy and security. Depending on local considerations in single-family residential neighborhoods, vertical accessways may be fenced on the property line and use restricted to daylight hours.

Standard No. 5

Public access to environmentally sensitive habitat areas such as wetlands, tidepools, or riparian areas should be evaluated on a case by case basis. Such accessways should be consistent with the policies of Chapter Three of the Coastal Act, and should be designed and constructed so as to avoid adverse effects on the resource and, where possible, enhance the resource. All such proposals should be reviewed by the State Department of Fish and Game and the Coastal Commission.

DEFINITIONS, SPECIFICATIONS, and LOCATION CRITERIA for ACCESSWAYS

Definitions and specifications are presented for lateral and vertical accessways, upland trails, scenic overlooks, bikeways, hostels and support facilities including needs for the disabled. The following standards for the location and distribution of coastal accessways, upland trails and other access related facilities apply to all new developments on currently undeveloped shorefront land, the infilling of existing developed shorefront areas, and the redevelopment of existing developed shoreline areas.

The specifications and criteria included are intended to apply to access right-of-way designations, dedications, and easements on both public and private lands. Specific criteria for the development and improvement of these accessways are covered in Chapter Three, Design Guidelines.

Standard No. 6

LATERAL ACCESSWAYS

Definition: An area of land providing public access along the water's edge. Lateral accessways should be used for public pass and repass, passive recreational use, or as otherwise designated in a certified LCP.

Specifications: Lateral accessways should include a minimum of 25 feet of dry sandy beach at all times of the year, or should include the entire sandy beach area if the width of the beach is less than 25 feet. They should not extend further landward than the foot of an existing shoreline protective device or be closer than 10 feet to an existing single-family residence, unless another distance is specified in a certified LCP. Where development poses a greater burden on public access, a larger accessway may be appropriate.

Location: Lateral accessways should be located on all beachfront land to provide continuous and unimpeded lateral access along the entire reach of the sandy beach or other useable recreational shoreline, such as along bulkheads. Exceptions to this standard might include military installations where public access would compromise military security, industrial developments and operations that would be hazardous to public safety, and developments where topographic features such as rock outcroppings or river mouths could be hazardous to public safety.

Facilities: The proximity of the ocean generally precludes any development on these narrow strips of land other than portable support facilities such as trash receptacles, picnic tables and benches, or retractable ramps or boardwalks designed for use by persons with disabilities.

Standard No. 7

VERTICAL ACCESSWAYS

Definition: An area of land providing a connection between the first public road, trail, or use area nearest the sea and the publicly owned tidelands or established lateral accessway. A vertical accessway should be used for public pass and repass, passive recreational use, or as otherwise designated in a certified LCP.

Specification: Vertical accessways should be a minimum of 10 feet wide as provided in the Coastal Commission's Statewide Interpretive Guidelines for Public Access.

Location: Vertical accessways should be established in all beachfront areas and should be evenly distributed and carefully located throughout such areas to the maximum extent feasible. They should be located where they provide access to onshore and/or offshore recreational areas.

Urban Areas: Where single family development exists or is planned, vertical accessways should be located where streets end at the shoreline, once every six residential parcels, or up to but not more frequently than once every 500 feet. New multiple family residential projects of five dwelling units or more should provide sufficient open space within the project for a vertical accessway, an adequate public parking area, and for construction of the access facility. Condominium conversions of existing multiple family developments of five dwelling units or more should, where feasible, provide a vertical accessway on-site. If such a facility cannot feasibly be provided within the project, it may be provided off site, but within the same general area. The presence of a public beach area with adequate access facilities nearby (within 1/4 mile) could reduce the needed frequency of vertical accessways in residential areas, as could alternative proposals from homeowners associations to provide adequate public beach access.

Commercial developments on shoreline parcels should enhance the shoreline experience by providing (or preserving) views of the ocean, vertical access through the project, and accessway facility construction and maintenance as part of the project. Industrial development of beachfront parcels should provide vertical accessway and parking improvements appropriate to safe public shoreline use, and according to the extent to which the potential public use of the shoreline is displaced by the industrial facility.

Rural Areas: Land divisions of beachfront parcels or shoreline parcels containing beach areas should provide a vertical accessway to the beach area either as a separate parcel or as an easement over the parcels to be created. For parcels greater than 20 acres in size, for parcels which contain more than one beach area, or where the beach area is one of substantial size (1/4 mile long or greater) more than one vertical accessway may be necessary. In rural areas, residential subdivisions or subdivisions for planned unit developments should provide vertical access facilities according to the previously stated standards for urban residential development.

Divisions of agricultural lands or timberlands should designate a vertical accessway (or accessways) of sufficient width to protect persons using the accessway and to protect adjacent crops. At least one vertical accessway should be provided on undivided agricultural or timberland parcels, through acquisition, if necessary, if the parcel contains a safe beach area appropriate for public use, and where this accessway would not interfere with agricultural productivity.

Facilities: Vertical accessways can be developed with a wide range of facilities including stairways, ramps, trails, right-of-way overpasses and underpasses, or any combination thereof. Drainage systems to prevent bluff erosion and shoreline protection measures may be necessary in areas where these factors are a problem. Vertical accessways should include appropriate support facilities.

Standard No. 8

UPLAND TRAILS

Definition: An area of land providing public access along a shorefront bluff or along the coast inland from the shoreline where the opportunity for lateral access along the water's edge does not exist. An upland trail can also link inland recreational facilities to the shoreline. An upland trail should be used for public pass and repass, passive recreational use, viewing the ocean and shoreline, or as otherwise designated in a certified LCP.

Specifications: Upland trail easements should be a minimum of 25 feet in width, and should in no case be located closer than 10 feet to an existing residence.

Location: Upland trails should be established on ocean front parcels of land, along blufftop areas, or on land further inland depending on topographic conditions for optimal trail location. Upland trails should provide continuous pedestrian and/or equestrian access for passive recreational use along portions of the coast where beach access is severely limited or non-existent. Upland trails should also be located to provide a connection between the shoreline and inland units of the federal, State, or local park systems, between shoreline access easements, or between the road and a scenic overlook. Upland trails should not be located on geologically unstable blufftop areas, on highly erosive soils, or on prime agricultural soils unless the trail easement would not disrupt agricultural production.

Facilities: Upland trail development can include clearing and grading of the trail tread; vertical and lateral clearing of brush; installing steps, footbridges, and hard surfacing where appropriate; providing an adequate trail drainage system; and the installation, where needed, of support facilities such as trash receptacles, benches, barriers, restrooms and signs.

Standard No. 9

SCENIC OVERLOOKS

Definition: An area of land that provides the public a unique or unusual view of the coast.

Specifications: Scenic overlooks should be considered an access destination, and access trails and support facilities provided where appropriate as determined by the use and location of the overlook area. Scenic overlooks should be accessible from a public road or from an upland trail.

Location: Scenic overlooks should be established on parcels that are accessible to the public road or an upland trail. Overlooks should be located on promontories or other areas that would provide vistas of a unique or unusually beautiful portion of the coastline. Once such an overlook is established, either by prior use or by designation in a certified LCP, scenic easements on surrounding parcels should ensure, to the maximum extent feasible, that permitted structures will not block or in any way diminish the views of the shoreline. Industrial developments occupying significant portions of the shoreline should provide a shoreline viewing area or suitable observation facility if vertical access to the shoreline is not feasible.

Facilities: Facilities can range from the minimal development of a roadside turnout with parking spaces, trash receptacles, and fencing as appropriate to protect private property and public safety, to a fully developed roadside rest area.

Overlooks which are away from the nearest road should be accessible by trail, ramps, or stairs, and facilities can range from simple benches to viewing platforms or pavilions. Scenic overlooks should include features to enhance access for persons with disabilities, including guardrails, curb cuts, and wheelchair ramps from parking areas to the overlook area.

Standard No. 10

COASTAL BIKEWAYS

Definition: A facility specifically designated to provide access to and along the coast by nonmotorized bicycle travel as classified in Section 2373 of the Streets and Highways Code.

(a) Class I Bikeway (Bike Path or Bike Trail)

Definition: Provides a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians, with cross-flows by motorists minimized.

Specifications: The minimum surfaced width for a Class I bike path should be 8 feet for a two-way path and 5 feet for a one-way path, with a provision for a 2-foot wide graded area adjacent to either edge of the path.

(b) Class II Bikeway (Bike Lane)

Definition: Provides a restricted right-of-way in the established paved area of highways designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross-flows by pedestrians and motorists permitted.

Specifications: The minimum width of a Class II bikeway should be 4 feet wide when located along roads in outlying areas where parking is prohibited, 5 feet wide where the overall roadway width allows parallel parking, and 11 to 13 feet wide on roadways where parallel parking is allowed but with specific striping on the roadway designating the parking area.

(c) Class III Bikeway (Bike Route)

Definition: Provides a right-of-way designated by signs or permanent markings and shared with pedestrians or motorists, used primarily to provide a continuous link between Class I and II bikeways.

Location: Bikeways should be provided throughout the coastal zone as part of the California Department of Transportation (CALTRANS) program for the development of nonmotorized transportation facilities. Bikeways should be developed in accordance with the criteria for location and design contained in Planning and Design Criteria for Bikeways in California, Department of Transportation, June 30, 1978.

Facilities: Development of a Class I bikepath involves grading and surfacing of the path, striping if necessary, and installation of vehicle barriers, bike racks, fencing and signs where needed. Class II and III bikeway development requires installation of signs and striping.

Standard No. 11

HOSTELS

Hostels are low-cost public travel accommodations, providing sleeping, kitchen and bath facilities for recreational travelers traveling in groups, families or individually. Based on the European model, hostels provide low-cost overnight lodging in a climate conducive to educational, social and cultural interchange for the traveler. Maximum stay is generally three nights.

Specifications: Each hostel site should provide sufficient bed space, kitchen, and sanitary facilities for a minimum of 24 people, one parking space for every eight overnight guests and one parking space for each residential staff person.

Location: Overnight facilities, such as hostels or campgrounds, should be located at intervals of 20 to 40 miles on or near the coast, and adjacent to or within two miles of recreational trails. No more than five hours of normal travel time by bicycle should be required to get from one overnight facility to the next. Where it is impractical to locate hostel facilities within desired travel distance, lesser accommodations such as campsites should be provided along accessways and/or park sites to link the existing trail network with hostels. Existing buildings should be used as hostel sites whenever compatible with surrounding land use and when renovation is economically feasible. Adaptable buildings in parks and public areas such as light station residences as well as suitable areas that could be developed for campsites should be given consideration for overnight facilities.

Facilities: Minimum support facilities for hostels and other overnight facilities should include public telephones, location signing along highways, and public transit stops.

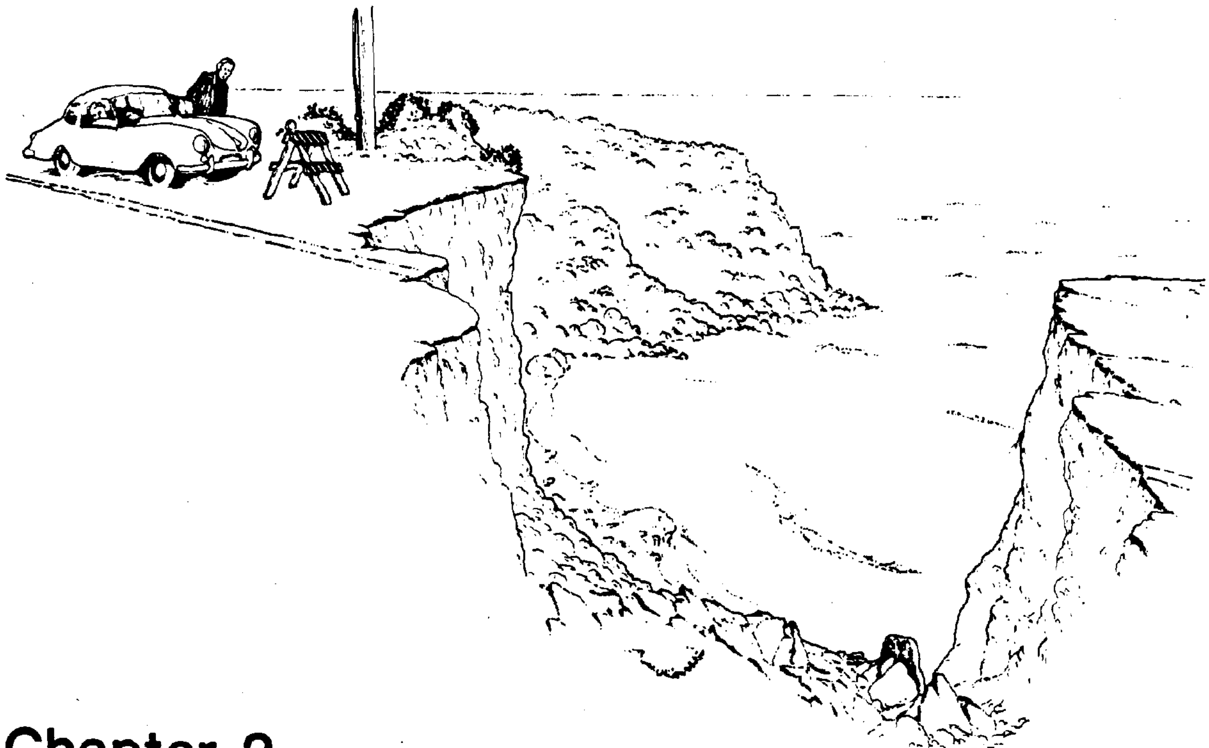
Standard No. 12

SUPPORT FACILITIES

Definition: Those facilities that improve ease of public use and maintenance of coastal accessways. Such facilities include signs, trash receptacles, public telephones, restrooms, showers, bike security racks, public transit loading and unloading areas, campgrounds and parking areas.

Specifications: The minimum support facilites for each vertical accessway should include signs at the nearest major thoroughfare and at the point of entry, and a trash receptacle. Additionally, each vertical accessway in an existing single-family residential area serving needs greater than those of the local neighborhood should include a minimum of five on or off-street public parking spaces or a transit stop within 100 feet of the accessway. Preference should be given to small, dispersed parking areas rather than large concentrated parking lots. Upland trails should be signed at every trail intersection and marked every mile if necessary to maintain the continuity of the trail in difficult terrain. All access facilities should be signed wherever warranted to alert users about their responsibility to respect privacy and avoid trespass.

Coastal access parking at facilities which are accessible to disabled persons should include at least one designated parking space for the use of disabled persons for every 20 spaces provided. Where vertical accessways have been specifically designed, improved, or signed for disabled persons' use, at least one of every five parking spaces should be designated for the disabled. Parking lots should be provided with curb cuts leading to all adjacent walks, paths, or trails. Restrooms and other public service facilities should be accessible to wheelchair occupants. Facilities for the disabled should be conspicuously signed.



Chapter 2

CRITICAL FACTORS in ACCESSWAY DESIGN

All access facilities must be carefully designed for the specific conditions of each site. To ensure the usefulness and longevity of the facility, special consideration must be given to some critical factors such as shoreline erosion, bluff and slope erosion, vandalism, and access for people with disabilities. The protective and preventative approaches that are discussed in this chapter are commonly used and can be applied by individuals or small organizations. However, in some cases project design, construction, cost, or location may require federal, state or local government assistance.

The information presented in this report is intended to highlight some of these accessway design problems, and should be supplemented by other more technical sources of information, especially when considering the final detailed design of an accessway. Further reports and additional sources of information regarding these problems are cited under Selected References.

SHORELINE EROSION

The surface characteristics of California's shoreline are extremely varied, ranging from exposed hard bedrock backed by eroded bluffs to wide unconsolidated sandy beaches. A thin veneer of sand or cobblestone may cover bedrock or the sand may be so deep that bedrock is never exposed. These surface conditions, which may change throughout the year, are often relied on as the foundation for an access facility. If facilities are designed without consideration of changing conditions, the facility is likely to be damaged by storms and shifting sands. The design of each access facility should therefore include investigations into the specific site conditions of geology, storm conditions, and erosion potential, prior to any development. In many cases, the design of an access facility can use the natural characteristics of the shoreline to provide effective and economical protection from potential damage.

BEACH CHARACTERISTICS AND SHORE EROSION

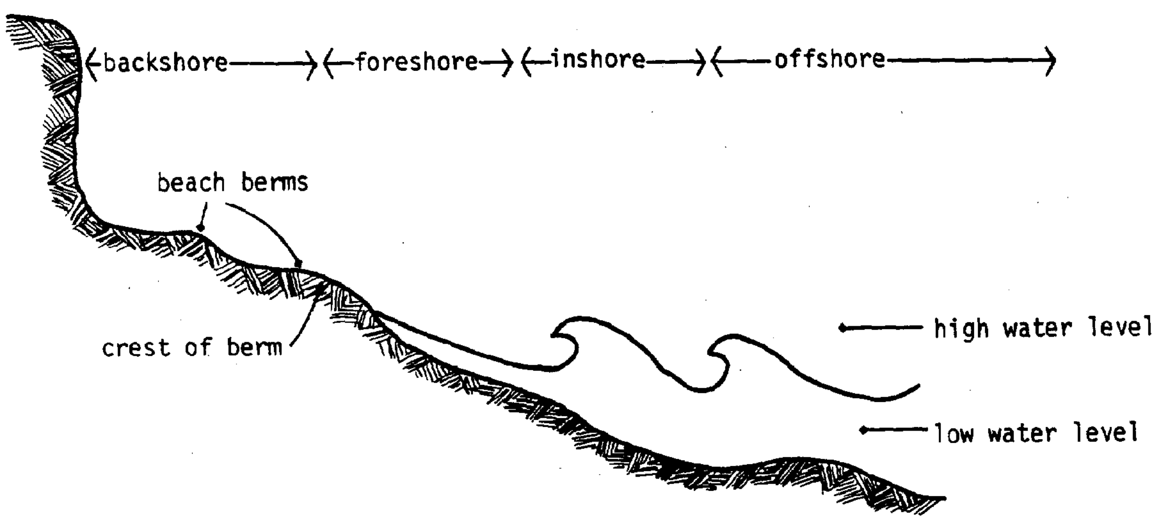
The characteristics of a beach that determine its effectiveness for shoreline and accessway protection include: the fluctuations of the elevation and width of a beach's berm, the slope of the foreshore (where the waves run up), and the slope of the inshore zone (which extends from the low water level seaward through the breaker zone).

At most beaches, the elevation and width of the berm fluctuate seasonally. In some cases, fluctuations may follow longterm cyclical patterns over a period of several years. Whether the sand is deposited or eroded away depends on the characteristics of the waves hitting the shoreline, local coastal currents, sand supplies, and the geography of the coastline.

Seasonal fluctuations in the berm of a beach are mainly caused by changes in the shape of the waves along the shore. Beach sand is deposited when the predominant waves reaching the beach are long and low. Typically, these waves have been generated by distant ocean storms and the waves have traveled a great distance. Beach sand is removed by short steep waves, typically generated by local storms along the coast. Erosion resulting from local storms is generally followed by gradual replenishment with sand supplied by swells. If local storms occur in succession, without enough time between storms for swells to replenish the beach, the shoreline may be severely eroded. Along California's coast, erosion is usually greatest during the winter. Summer swells gradually rebuild the beaches. Longterm changes in the size and shape of a beach may follow changes in the amount of sediment supplied to the shoreline by inland streams or by the construction or removal of nearby breakwaters, groins, jetties, or other structures that affect the transportation of sands along a coastline.

Both seasonal and longterm erosion result in a markedly narrower beach with a steeper foreshore and inshore slope, which allows waves to break closer to vulnerable bluffs, cliffs and man-made structures located behind the beach. In contrast, uneroded wide beaches with gently sloping foreshore and inshore slopes offer the greatest natural protection from storm wave damage.

When considering the design and placement of accessways, it is crucial to determine the greatest possible erosion and storm wave activity which could foreseeably occur at the site. If the changes in elevation or width of a beach are significantly more than those anticipated, the natural defense against storm wave impact could be reduced and the structural integrity of an accessway could be threatened.



PREVENTIVE MEASURES

When an access facility fails, it usually fails nearest the shoreline, whether the structure is a staircase, ramp, trail or path. There are three common causes for failures at this point.

1) Direct damage from waves breaking on or near the structure;

2) Debris dashed against the base or supporting members of a structure;
3) Excessive beach erosion at the base of an accessway or toe of a bluff, damaging the foundation of a staircase or crumbling the lower end of a ramp, trail, or path.

General preventive approaches to reducing storm wave or erosion damage to accessways usually emphasize siting, design, and installation of shoreline protection devices; these must be considered early in the design of facilities. Access facilities that have successfully withstood storm damage frequently incorporate several of these approaches.

Build for Maximum Storm Damage

Designing an accessway that is sturdy enough to withstand the greatest storm impacts and shoreline changes (within the limits of cost and specific site conditions) is the most obvious approach to limiting storm-caused damage to a facility. These facilities can be designed to safely absorb the energy of storm wave impacts and debris dashed against the structure, and to withstand erosion of the shoreline and bluffs. Such construction often involves the use of costly materials; design development requires experienced engineers; installation requires contractors and skilled labor. If the facility is damaged - which happens to even well designed structures - repair parts and labor will again be expensive.

Designing facilities to withstand storms minimizes the frequency of repair, although not necessarily the cost of repair in the long run. Good design and construction also increase the probability that the facility will be intact for emergencies, such as for evacuation of someone from a beach because of an injury. Some jurisdictions have used this approach partly out of concern over liability suits. If a liability suit is brought over an injury that was incurred when the accessway was in disrepair due to storm or erosion damage, the agency managing the accessway can show that the facility was built to the best possible design available.

Build for Moderate Conditions - Anticipate Repairs

A simply designed accessway built with commonly available and easily installed materials may provide a more cost effective facility. Use of on-site, donated, or recycled materials may result in lower material costs. Because repair and installation require less use of specialized skills, labor provided by volunteer groups or government work programs such as the California Conservation Corps can be more extensively used. Also, expensive design or site engineering will be required less often.

Stairways constructed using railroad ties, reclaimed concrete blocks and car tires, dug and anchored into a slope, are farther a facility is from the water's edge, the greater the distance storm waves must travel before reaching the structure. This reduces the amount of damaging and erosive energy the waves contain at the time of impact on or near the accessway. Designs incorporating this approach include stairways and ramps which descend parallel and adjacent to a bluff, rather than descending perpendicular from the bluff towards the shoreline.

Provide Shoreline Protection Devices

A gently sloping beach, beach berms, and dunes absorb the energy of storm waves and protect the coast from excessive erosion or inland flooding. When shoreline development and construction of access facilities encroach on these natural protective features, artificial shoreline protection may be needed to protect structures. Common shoreline protection measures include the construction of seawalls, bulkheads, and revetments. Seawalls and bulkheads are usually used only to protect inland areas from erosion and are rarely installed to protect accessways. The more commonly used rock revetments help absorb the high energy transmitted to access structures from storm wave impacts. A revetment can also provide a solid foundation for a structure in an area of beach instability, and can prevent excessive erosion and undermining of the base of a bluff.

However, artificial shoreline protection is extremely expensive. Even a small revetment at the base of an accessway may cost as much as the accessway itself. Therefore, revetments should be considered only when accessways cannot be relocated or built in an alternate manner.

Revetments are limited to protecting only the land areas immediately behind them. They do not prevent erosion of adjacent beach or bluff areas, do not prevent recession of a shoreline, and do not reduce erosion of the beach seaward of the structure. In fact, erosion may be accelerated on the seaward side of the structure if the revetment is improperly designed or constructed. Shoreline protection structures may also increase erosion downdrift from the site by eliminating a source of sediment or by interrupting natural coastal processes.

The Department of Boating and Waterways sketches on the opposite page show rock rip rap being used to repair the storm damaged stairway at El Capitan State Beach in Santa Barbara County.

examples of this approach. Although these facilities may require more frequent maintenance, long range costs may be less because of the type of labor and materials involved. However, this approach is not always feasible on extremely steep slopes, in unstable areas, or in areas of intensive use. In addition, since these facilities are generally more vulnerable to damage, the accessway may not be open at all times, an important consideration along shorelines where emergency access is limited.

Limit Construction in Areas of Maximum Potential Damage

Since the lowest end of the access facility nearest the shoreline is the most susceptible to damage, the base and bottom portion should either be reinforced or the lower-end should be removable or easily repaired. The most fragile or most expensive portion of an accessway should be above the shoreline erosion and storm wave zone.

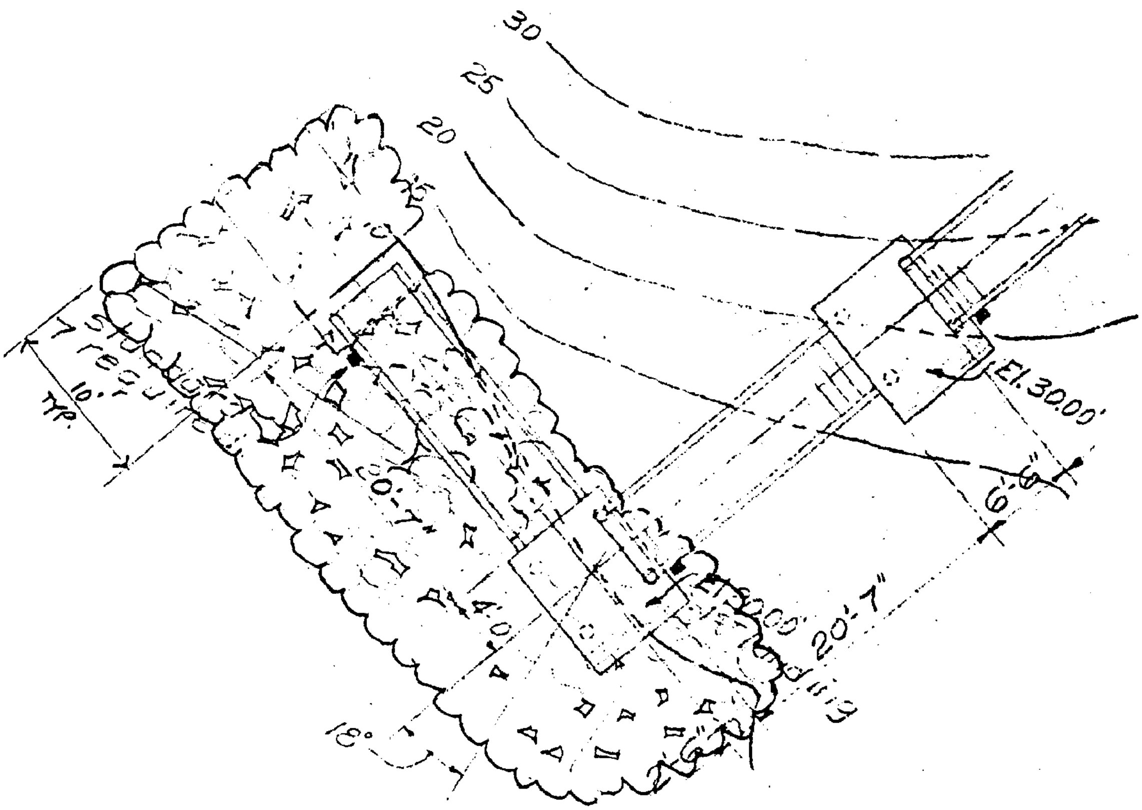
Examples of this type of design include wooden stairways with the lower steps made of concrete and staircases that lead to a short portion of easily and inexpensively repaired ramp or trail near the beach. At Prairie Creek Redwoods State Park in Humboldt County, footbridges built in the flood zone of creeks are removed during the winter high water season. This approach has a disadvantage in that the facility can not be used when the lower portion is removed or damaged.

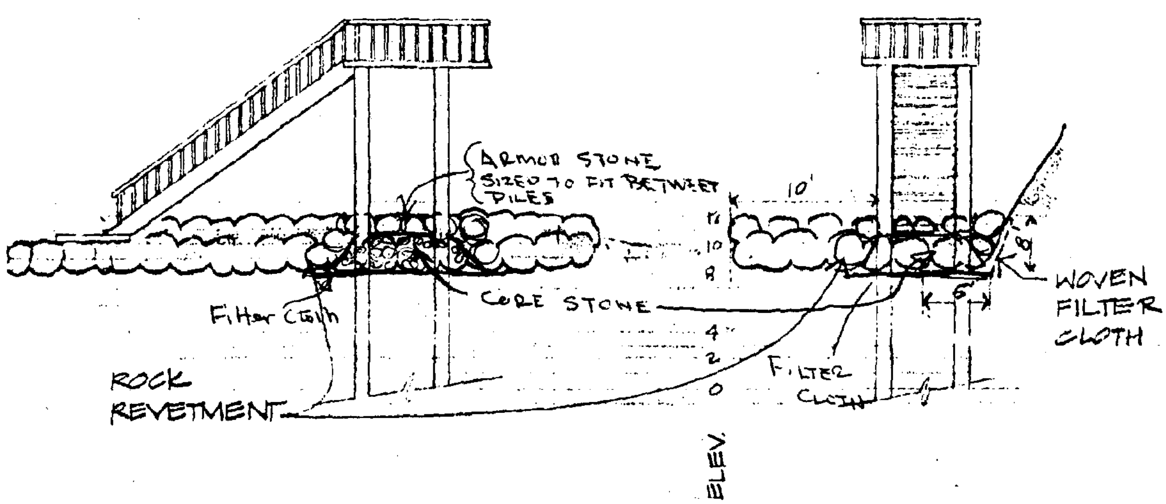
Locate Facilities Away from the Shoreline

Accessways located on steep bluffs or hillsides should be designed such that the structure is nearest the toe of the bluff and as far as possible from the ocean's edge. The

ROCK RIP-RAP AT STAIRWAYS

STORM DAMAGE REPAIR





BLUFF AND SLOPE EROSION

The storm activity that contributes to beach erosion also affects adjacent bluff and cliff faces. Surface soil erosion, slope creep, mass soil movements, and landslides are natural processes that constantly reshape landforms. At least one of these processes can be expected to occur at most sites; in many situations, human activity and disturbance may accelerate them. As with beach erosion, bluff and slope stability and erosion at a specific site should be thoroughly understood prior to accessway development.

BLUFF AND SLOPE CHARACTERISTICS AND EROSION

Bluffs and slopes can erode in either mass soil movements and landslides or surface soil erosion. Mass soil movements include debris falls, slides, flows, complex slides, or soil and bedrock creep. These slope failures occur where the downward stress on a portion of a bluff or hillside has exceeded the ability of the material to hold itself together. Other than creep, mass soil movements usually take place over a short time period. Engineers or geologists can inspect accessway sites and identify areas where slides may occur. With proper analysis, these areas can be avoided.

Surface soil erosion occurs whenever the amount of surface water from rain, irrigation, or any other source exceeds the infiltration capacity of a soil. The water that builds up on the surface flows downslope carrying soil with it. The construction of impermeable surfaces, the removal of vegetation and the building of accessways which intercept and collect or concentrate runoff that would normally be dispersed over a large area aggravate surface soil erosion. If allowed to continue, surface erosion leads to rilling and gullying of soils. Once this occurs, it becomes increasingly difficult to stop the erosion by diverting or dispersing the runoff.

PREVENTIVE MEASURES

Bluff and slope erosion may occur when the following conditions are present:

1. The weight on or within a portion of a slope has been significantly increased.

2. Water saturates a slope, adding weight to the hillside and possibly decreasing the cohesiveness of the soils.

3. Slope gradient is increased, either when surrounding land is graded or when the supporting base of the hillside or bluff has been eroded.

4. Removal of vegetation has left a slope without surface vegetation to minimize the impact of rainfall and without root systems to help bind the soil.

5. Rainfall runoff accumulates on the soil surface, leading to surface erosion, including gullying and rilling.

Increased Weight or Loading

Increased loading from the installation of a structure or fill will increase the downward stress of slope material and may increase water pressures within the soils. Normally, the stability of a slope is partially dependent upon the friction which exists between soil particles. Excessive weight on some soils, particularly those with high clay content, transfers the load from contacts between soil particles to the water between the particles. This condition results in decreased shear strength and possible bluff or hillside failure.

Increased weight or loading is significant primarily on slopes which are unstable. Accessways of excessive weight such as massive concrete staircases or large blufftop parking areas or buildings aggravate this instability. Facilities should be preferably located away from the seaward edge of any unstable bluffs. Structures built near a bluff's edge should have supporting piers and foundations which are sunk into bedrock, or as deep as is economically feasible.

Water Drainage Into and Over Slopes

On the California coast, excessive water drainage into and over bluffs from surfaced parking areas, street ends, or other paved areas is one of the most significant factors contributing to bluff, slope, and accessway failure. Water entering a bluff will increase the weight of the soil, leading to greater downward stress. In some cases, this may increase internal water pressure which reduces slope shear strength. Water can also change the consistency of materials on or in a slope, leading to a loss of cohesion and internal friction of some layers of soil. These soil layers contribute to slope failure by acting as an unstable layer within the bluff or hillside.

Inadequate parking lot and street drainage systems and the failure of such systems also contribute to bluff erosion. If a drainage system is inadequate or clogged, runoff collects and unexpectedly overflows down bluffs, eroding both bluffs and accessways. If subsurface drain pipes or culverts have corroded through or have been broken by slipping or faulting of the bluff, water may pass through the break and enter the interior of a bluff or hill, leading to a change in consistency of the soils and excessive weight problems. Since a break in the drainage lines usually occurs at or near the point of slipping or faulting of a bluff, water enters the weakest point of the bluff and further aggravates slope failure.

Measures recommended to minimize the problems of water drainage into coastal bluffs and hillsides include the following:

- Wherever possible, surfaced parking areas and streets should drain away from bluff edges. Covering parking areas with permeable materials, such as gravel, to drain rainfall over a dispersed area away from bluff edges may create other problems. Infiltration often contributes to failure or slipping of coastal bluffs. Runoff should be drained into natural water courses.

- Drainage systems should be designed for the maximum intensity of rainfall and runoff expected at a site. Ideally, the system should be able to function with partial clogging of the inlets or grates. The failure of any upland drain systems should be anticipated; bluff erosion has been caused by the unexpected overflow of drainage water from streets which were significantly above and distant from the shoreline.

- Culverts and drainpipes should be extended all the way down bluffs, so that drainage water does not flow onto the bluff face.

- Drain systems should be designed to be resistant to corrosion and to be tolerant of movements of the bluff or slope.

- Bluffs which suffer from significant water loading should be avoided or fitted with drains to remove water from the interior of the slope material.

Undercutting of Bluffs and Increases in Slope Gradients

Coastal storm activity often tears away at the base of unprotected bluffs, leading to undermining of the bluff or cliff face. If the loss of a supporting base is excessive, bluff failure may occur, especially if the water content of the bluff has been increased.

If slope gradients are increased too severely by excessive trail, path, or ramp grading, runoff and erosion help bring

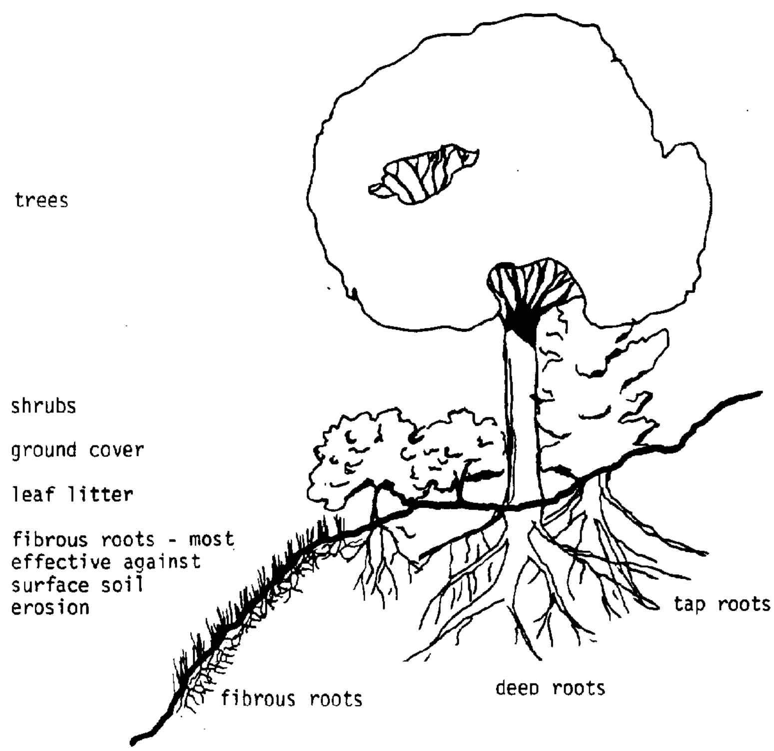
Photos illustrate drainage grate and culvert at state park in Del Norte County, California.

about mass soil movements or landslides. The safe amount of grading possible depends upon the stability of the slope material, which is highly variable along the coast. Bluff failures or surface erosion due to increased slope gradients can be reduced by: constructing shoreline protection structures which minimize storm erosion, providing or preserving vegetative cover, and avoiding development in areas which are unstable or vulnerable to shore erosion.

Vegetation

The significance of vegetation to slope stability and to the prevention of surface erosion can not be overemphasized. In addition to its aesthetic qualities, vegetation minimizes the erosive impacts of rainfall, increases the soil's water-holding capacity, and helps bind soils, thus decreasing erosion and the potential for slope failure.

Without vegetation, even the impact of raindrops can cause soil erosion, without any surface runoff of water. When raindrops hit uncovered soil, the impact is great enough to dislodge soil particles and bounce them downslope. Although this takes place on an extremely small scale, during intense rainstorms the frequency of raindrop impact is great enough to



EROSION CONTROL PROVIDED BY ROOTS

move soil particles downslope without ever having any water drain over the soil. By covering the soil with a protective layer of fallen and decaying plant material, and by providing a canopy of foliage, vegetation intercepts rainfall and lessens its impact.

Soil rich in humus from decayed plant material has a greater water-holding capacity. Humus increases the amount of water a soil can absorb before reaching saturation, thus reducing the amount of water which flows over the soil surface and which contributes to erosion.

Through development of root systems, vegetation binds soils together, increasing the cohesiveness of soil particles. At most sites, the presence of vegetation and developed root systems is favorable. However, in a few instances the penetration and expansion of deep tree roots into fractures and separations of bluffs has contributed to mass movements of slopes.

Where vegetation has been removed, slopes should be replanted. Native, perennial plants, which are usually hardier and remain alive year round, are recommended because they offer greater slope protection. Vegetation that requires little or no irrigation should be used. Fibrous rooted plants, such as grasses, are most effective against surface soil erosion. However, the practice of replanting denuded slopes with annual grasses must be carefully considered, because the grasses often do not develop a significant root system until well into the winter rainy season, after a majority of slope erosion has occurred.

Design and placement of the accessway should insure that future use of the facility will not degrade existing vegetation. Concentrating foot traffic on maintained paths and away from dunes, bluffs, and slopes protects vegetation and prevents gully formation.

Channeling of Runoff

Collection of surface runoff on trails, staircases and observation decks can be a problem. To prevent these problems, surface drainage should be considered and measures to reduce possible erosion provided. In particular, impermeable and otherwise slick surfaces collect runoff and may need riprap at drain outlets to prevent washout of surface soils. These measures, which may include waterbars, gutters or culverts, are discussed briefly in Chapter Three, Design Guidelines.

ACCESS FOR THE DISABLED

Coastal access facilities should be designed for use by the disabled, whenever this would not result in material damage to the environment or unreasonable hardship. If the facilities are constructed with state, county, or municipal funds, or the funds of any state political subdivision, California State laws (Government Code § 4450) instructs that buildings, structures, sidewalks, curbs and related facilities be accessible to and useable by the physically handicapped.

NEW STATE REGULATIONS

New state regulations entitled Regulations for the Accommodation of Physically Handicapped Persons in Buildings and Facilities Used by the Public, will go into effect in 1982. The following excerpts from these regulations are especially applicable to the development of coastal accessways.

"A public accommodation or facility" has been defined as a state-funded "building, structure, facility, complex or improved area which is used by the general public, and has any reasonable availability to, or usage by, physically handicapped persons".

Accessible Facilities

Handicapped persons can use various recreation and rest areas when these can be reached by automobile. A reasonable portion of such facilities shall be constructed so that the handicapped can participate in the various activities that are available.

The following parks and recreational facilities are among those expected to comply with state regulations:

- Visitor centers and sanitary facilities serving these centers.
- Beaches, picnic areas, day use areas, vista points and similar areas.
- Sanitary facilities, where provided, in each public use area that is accessible to wheelchair occupants by automobile, walkways, or other paths of travel.
- Parking lots shall be provided with handicapped parking spaces and curb ramps leading to all adjacent walks, paths, or trails.
- Trails, paths, and nature walk areas, or portions of these, shall be constructed with gradients which will permit at least partial use by wheelchair occupants. Hard-surface paths or walks shall be provided to serve buildings and other functional areas.

Exempted Facilities

While the new regulations require access to the disabled, exceptions have been provided in two circumstances. If the enforcing authority finds that, in specific areas, the natural environment would be materially damaged by compliance with these regulations, such areas shall be subject to these regulations only to the extent that such material damage would not occur. Automobile access shall not be provided or paths of travel shall not be made accessible to the disabled when the enforcing authority determines that compliance with these regulations would create an unreasonable hardship.

These state standards for access for the disabled have been incorporated into these design guidelines where appropriate. However, to assure full compliance, a copy of the regulations should be obtained from the State Architect's Office.

VANDALISM

When coastal accessways are opened, adjoining landowners often express concern about vandalism of both the accessway as well as of neighboring properties. Public use alone does not cause vandalism. Vandalism, when it does occur, is usually sporadic and is related to the design, location and popularity of a facility. Acts of vandalism are often thought to be senseless, but experience indicates that incidents generally occur at facilities which invite or allow opportunities for damage.

During accessway planning, consideration of the following issues will help create facilities less susceptible to vandalism.

Design for Easy Supervision

Enclosures which are accessible but not open to public view or easy supervision should be avoided. Vandals prefer to act in areas where they cannot be observed. Accessways that are enclosed by fencing and gates cannot be supervised or observed from the road, beach, nearby residences or businesses. These are more susceptible to damage than accessways which are relatively open and visible. Vandalized accessways will be avoided by neighbors or the general public because of their delapidated condition and the vandals they attract. A decline in use will further reduce any chances of informal supervision or scrutiny, compounding the vandalism problems. In attempting to provide privacy to residences adjoining accessways, screens for vandals should not be created.

Though locked gates may provide some protection, they also can create problems. At a Southern California accessway, gates are locked at night to restrict access and reduce vandalism during non-daylight hours. However, law enforcement officers without keys have difficulty in supervising or readily entering the locked accessways. In general, small accessways (e.g., ten foot wide paths or stairways) that directly adjoin residential housing may be best managed by installing gates. Larger accessways (e.g., public beaches with on-site parking areas) may be better managed without gates.

Provide for Direct Routes

Accessways should provide the most direct and open route possible while maintaining privacy to adjoining residences and avoiding unnecessarily steep gradients. Although meandering and curving paths may be aesthetically pleasing, people will choose the most direct route possible, sometimes damaging vegetation and increasing erosion. When changes in the direction of an accessway are necessary, use sturdy materials and effective barriers to restrict misuse.

Anticipate Alternate Uses of Facilities

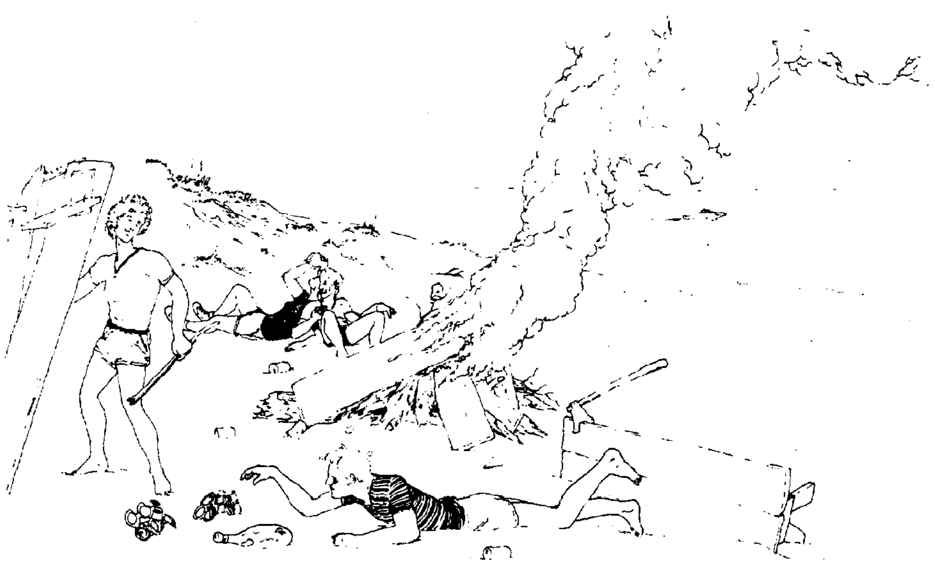
Attention should be given to possible dual uses of improvements. Railings can double as seats; fences can double as bike racks. Facilities should be designed for possible dual uses, to reduce damage caused by unexpected misuse.

Involve the Community

The concerns of the local community and user groups should be included, where possible, in the planning and construction of accessways. Community organizations and individuals should be involved early in the planning of an accessway project. The establishment of community and user group support for an accessway can result in informal maintenance and surveillance of the facility and beach. A community that is overly hostile towards the development of an accessway may cause, or simply permit, malicious vandalism, motivated by anger or the desire to keep a beach private.

Design for a Variety of Groups

Accessways should be constructed where they will be used by the greatest number of diverse groups. If an accessway or beach begins to be used only by a select group, that group may eventually feel that the area is "theirs." Graffiti and other acts of vandalism may result as an attempt to repel others.



To reduce this problem, facilities should be well signed, well maintained, and preferably located where they are obvious from a road or parking area.

Provide Easily Repairable Facilities

Facilities should be made of materials that are easy to clean, repair and replace. Designs which call for special tools and skills to repair, or which require one-of-a-kind parts or difficult to obtain parts should be avoided. Avoid creating large expanses of walls that attract graffiti. Damage by storms and vandalism should be anticipated for any facility. If this damage can be repaired by non-technically trained individuals using simple and inexpensive tools and materials, the facility will be easier to maintain and keep open.

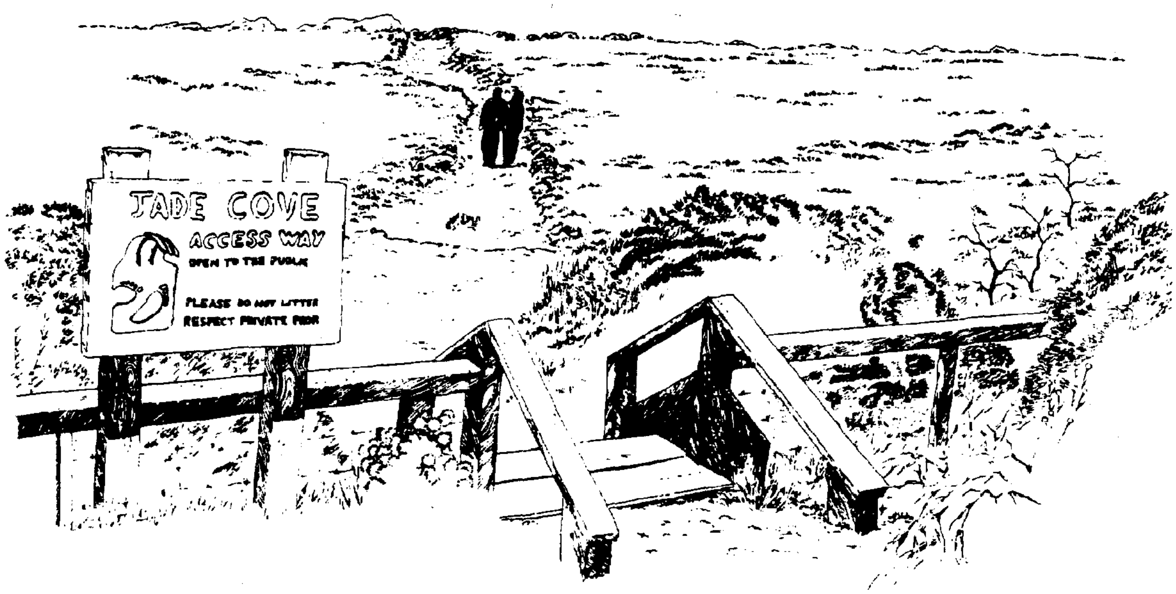
Repair Damage Quickly

Quick repair of facilities can limit future damage. Many acts of vandalism do not occur until someone has already damaged the facility. Facilities which remain in disrepair for long periods of time invite further vandalism.

Avoid Designing Easily Dismantled Structures

Exposed bolts and screws, or other means of attachment or points of leverage which may be used to dismantle a structure should be avoided. This advice is especially pertinent for wood structures built in areas where fuel for beach fires is in great demand. People scavenging for firewood will dismantle staircases, fences, and railings using crowbars or makeshift tools.

Although it is necessary to construct facilities which are durable and resistant to storm and vandal damage, creativity in the design is also important. Ugly structures, though they may guarantee low maintenance, may not be well used or accepted.



Chapter 3

DESIGN GUIDELINES

The following guidelines provide minimum standards and basic dimensions for the design and location of various types of coastal access facilities. Also included are suggestions for accessway designs, ranging from simple to complex.

The information presented in this chapter is intended to provide guidance in the choice and design of specific access facilities. The successful development of a well-designed access facility is dependent on local and often unique factors which are difficult to standardize. This information should therefore supplement the expertise and criteria of local governments and community groups.

TRAILS AND WALKWAYS

Coastal trails and walkways are used for hiking, walking, horseback riding and occasionally for public services such as rescue and fire fighting. Of all coastal accessway facilities, trails are the most versatile in regard to their location and the amenities they provide. Trails and walkways not only provide access but also serve as recreational destinations in themselves, especially where they pass through scenic areas or provide coastal views. Generally, the trail or walkway should provide a link between a road, parking lot, or other trails and recreational destinations such as beaches, parks, viewing areas, or blufftops.

TRAILS

Because of the minimal materials and labor required, natural-surfaced trails usually have lower construction costs per linear foot than other facilities, making them well suited to areas where installation cost is a major constraint. Although trail maintenance costs are typically low, the frequency of required repairs can be high because natural trails are susceptible to erosion and overuse. Annual maintenance of trails should be anticipated.

In low-use areas where relatively undeveloped sites, such as parks on undeveloped coastal land, are desired, trails may be the only appropriate accessway type. In heavily used areas, surfacing and widening of a trail may be appropriate to reduce the impacts of use on the accessway and adjacent lands.

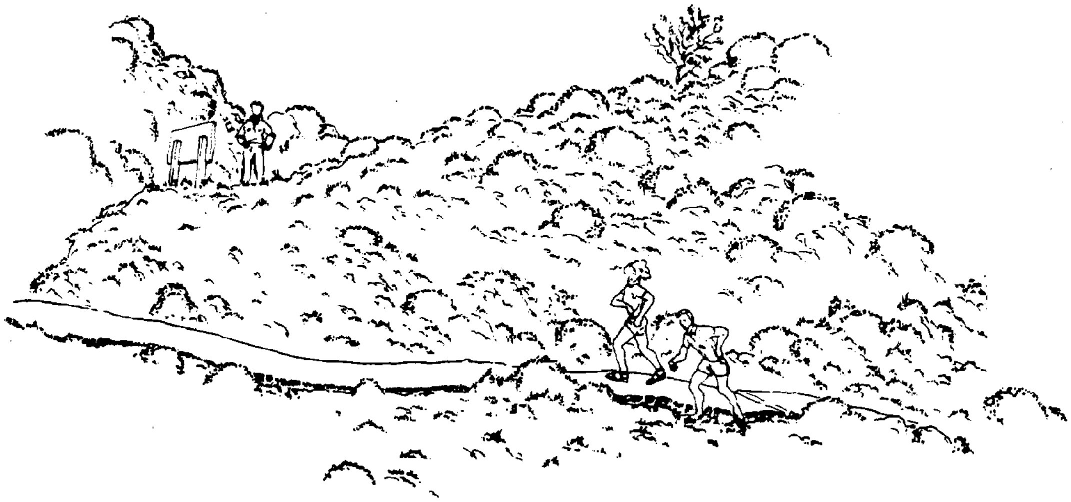
Trail Design Criteria

Trails should be creatively designed and located. A trail should stimulate a person's interest and enjoyment of the surroundings and should be a desirable place to revisit. Trails should instill a feeling of independence for a hiker, rather than restriction.

Where possible, trails should be free of barriers that restrict access to people with disabilities.

Trails should be signed according to the degree of difficulty they present. Long or fatiguing trails should offer people the option of turning back at several points, preferably without having to retrace their steps. Vista points can provide intermittent destinations and rest stops.

Trail location should follow previously informally made trails, unless land ownership, privacy, resource protection,



or other considerations prevent this. These informal routes are usually the most direct, and people are likely to continue to use them regardless of future development.

Location of trails should avoid close proximity to structures and private residences.

Hand construction of trails is preferable to machine construction, which should only be used in disturbed areas or where the trail also provides a service vehicle route. Visable evidence of trail construction should be restricted to the area of the trail width.

In wet or damp areas, or areas of fragile habitat, the trail surface should be raised by construction of a boardwalk or a footbridge. A trail should be graded or built up only if this will not damage fragile areas.

RAISING A TRAIL THROUGH WET AREAS

Trails should start at easily accessible points: near highways, roads, parking areas, or other developed recreational areas. The start of a trail, or "trailhead," should provide facilities for hikers and walkers, including parking areas, restrooms, water, picnic areas, signs, and trash receptacles.

Rest areas should be provided along trails at viewpoints, areas of special interest, and along or at the end of long uphill grades. Additional width should be provided at these areas. Facilities can include benches, tables, signs, viewing pavilions, and where needed, restrooms.

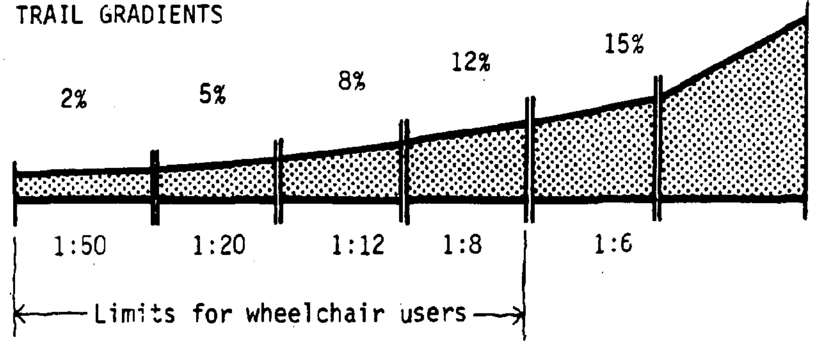
Vehicles can be prevented from entering trails by installing posts 18 inches apart, by constructing walk-through stiles or self-closing gates, or by bolting or chaining logs to the ground at the trail entrance. However, any vehicle barrier can potentially be a barrier to the disabled; wide, walk-through stiles are preferable, as they allow wheelchair access.

Trail Gradient

Trail gradient should ideally be gentle and varied. Long stretches of trail at a constant grade should be avoided, because they are monotonous and tend to tire walkers. Gently undulating trails provide variety to hikers and natural surface drainage. A maximum average trail grade of 5% to 10% is recommended; grades between 10% and 15% should be limited to short segments. A gradiet of 10% is generally considered the maximum gradient for comfortable walking for most people; gradients of 15% are considered steep and difficult to continuously climb. Unsurfaced trails at these steep gradients will erode from use or water drainage.

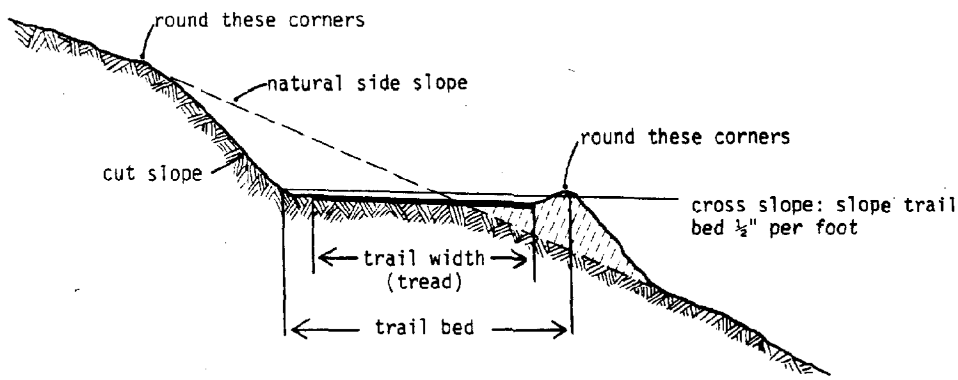
Because of coastal terrain, informal use, or limited funds, trails are sometimes formed on slopes much steeper than 15%. With low use, erosion control and occasional reinforced steps, these trails can provide access to those willing and agile enough to use them. If trail gradients greater than 15% are necessary over a long distance, the construction of switchbacks or installation of steps is recommended.

TRAIL GRADIENTS



Gradients at approaches to switchbacks and turns should not exceed the average grade of the trail and should be as level as possible. Long, gradual switchbacks are preferred to short steep switchbacks, which create gradient and erosion problems. Switchbacks should be located and constructed so that hikers are not tempted by shortcuts, which contribute to vegetation damage and erosion.

Steps constructed on trails should conform to the recommendations listed in the stairways section. Any steps should be reinforced and surfaced; steps that are cut into a slope but not surfaced become slippery when wet and easily erode.



TYPICAL TRAIL (PARTIAL FILL)

Cross-Slope

Cross-slope refers to the slight pitch of the trail tread surface to permit the runoff of drainage water. Cross-slopes range from 2% to 5%, and are usually angled out-slope, so water drains off the tread and down the bluff or hillside. In some specific instances, the cross-slope may be angled into the slope.

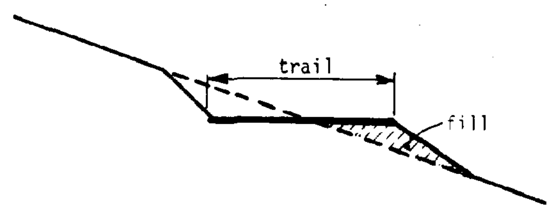
Side-Slope

Side-slope is a measure of the natural gradient of a hillside prior to access development. The degree of side-slope helps determine the amount of excavation required for a proposed trail.

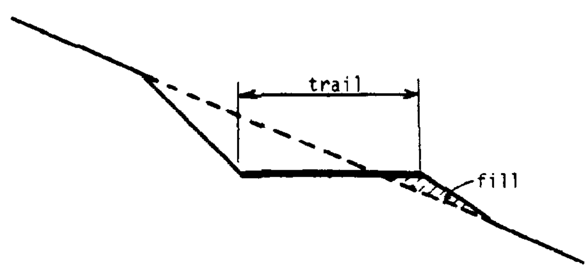
The following recommendations, derived from the U.S. Forest Services's contract specifications for trail construction, are designed to help minimize erosion and maintenance.

- On side-slopes of 10% or less, duff and leaf litter should be scraped from a trail to expose, but not remove, mineral soil. Grading is not recommended, except to create a smooth trail surface.

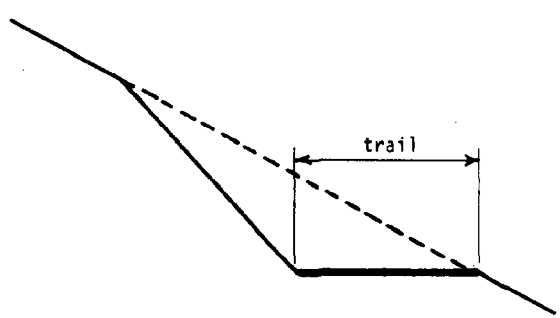
- On side-slopes between 10% and 30%, the trail should be constructed with a balanced bench section.



- On side-slopes exceeding 30%, the width of the trail should be decreased, until at 40% the sideslope of the trail bed is constructed on a 3/4 bench



- Full bench construction is recommended on side-slopes of 50% or greater, or in areas of solid rock.



- Trails in talus or rubble areas should be constructed by building the trailbed out from the slope, instead of cutting into a bank and risking increases in landslides or slope failures.

Cut-Slope

Cut-slope refers to the slope adjacent to a trail, following excavation. The degree of cut on any hillside depends on the soil stability, type, and hardness. Where excavation creates excessively steep cut-slopes, especially in areas of instability, they should be terraced or reinforced with wood or stone retaining walls. Cuts should be steep, but not cause erosion or loss of stability. On a gentle slope with stable soil, the cut may form as much as a 2:1 slope (2 feet back per 1 foot height). A 1-1/2:1 slope will remain stable, and a 1:1 ratio is about as steep as earth will lie on a slope, even in the most stable conditions, without a retaining wall. In spots where a 30 to 40-foot grade would be necessary to attain a 1:1 slope, a retaining wall may be necessary.

Width

Minimum recommended trail width is 30 inches, with a 3 to 4 foot width suggested. Where the trail is narrow, passing areas should be provided at level spots or along gentle slopes. The trail should be wider at hazardous areas. In special situations, such as a nature trail through a meadow, the trail may be as wide as eight feet for a short distance, in order to accommodate large study groups.

Surfaces

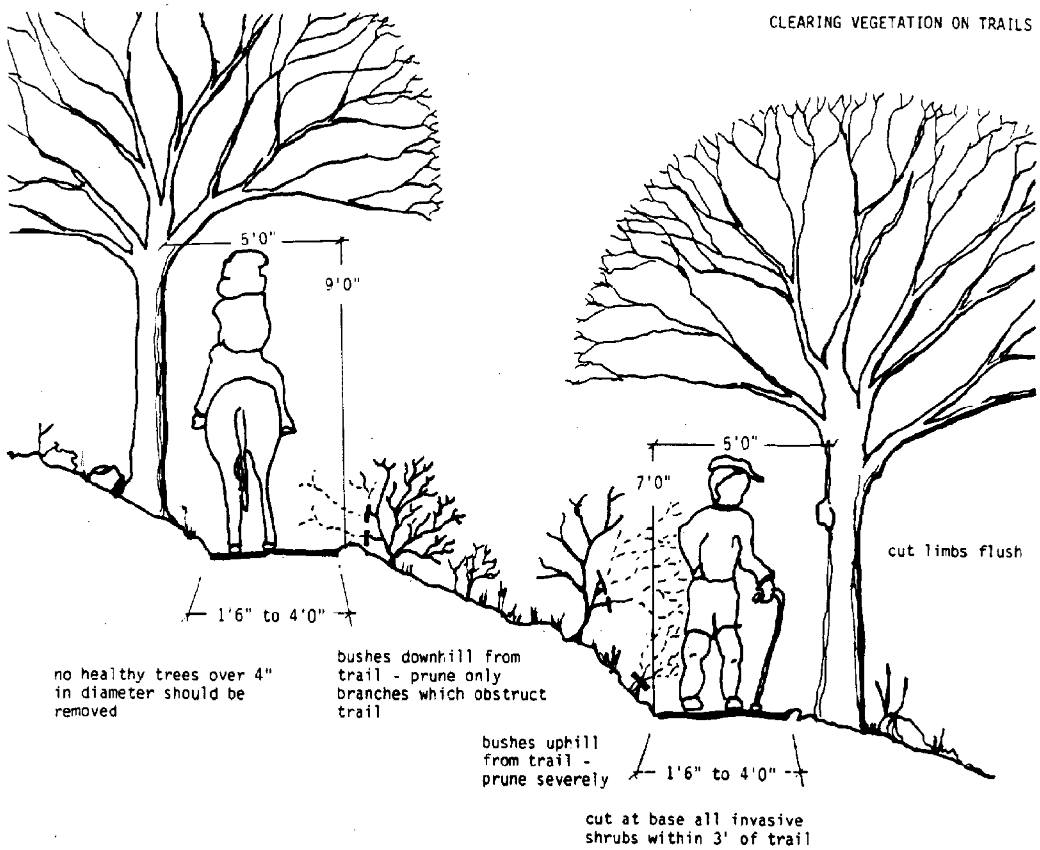
Trails are often best left unsurfaced, after the natural soils are compacted and the trail bed is cleared of leaf litter and obstructions. If a moderately used trail will not present hazardous slick surfaces when wet or increase erosion problems on steep gradients, a natural surface is usually adequate and preferable. If a trail is located in an area of heavy use or steep grades, or if it will be used by disabled people, hard surfaces can be beneficial. Examples of trail surfaces are given in the Drainage Devices, Surfaces, and Handrails Section.

Erosion

The importance of preventing accumulation of rainfall runoff on a trail surface cannot be overemphasized. Drainage water flowing down or adjacent to a trail is a major cause of erosion. The simplest and most attractive method of draining runoff from a trail is pitching the surface slightly out-slope. In areas of switchbacks, where this practice may drain water onto the trail below, or where the out-slope of a trail is unstable or easily eroded, runoff can be drained into a ditch or gutter adjacent to the cut-slope or bank. However, runoff from these ditches will undermine the adjacent cut-slopes, if regular maintenance does not keep them clear.

Other important measures that prevent trail erosion include:

- Trails should not be located in areas of unstable soils.



- Trail grading and removal of vegetation should be kept to a minimum.

- Trails that cross natural drainages should not divert runoff onto an accessway's surface. Waterbars and culverts should be installed where drainage is a problem.

HARD-SURFACED WALKWAYS

Walkways surfaced with concrete or asphalt are sometimes preferable to natural-surfaced trails. Hard, smooth and nearly level walkways can provide access for the disabled in all but a few situations. They are appropriate in the following situations:

1) Accessways with level terrain (slopes less than 5%),
2) Accessways with a short distance between a parking or public transportation area and points of interest such as the beach or viewing points,

3) Accessways which generally receive heavy use, where a paved trail could reduce disturbance to vegetation and soil adjacent to the walkway.
4) Accessways where well-defined boundaries are desirable. This may include boundaries that guide the visually and physically disabled, provide distinct edges to an accessway in sensitive areas, or provide hard surfaces where the base material is loose and shifting, such as at dunes or beaches.

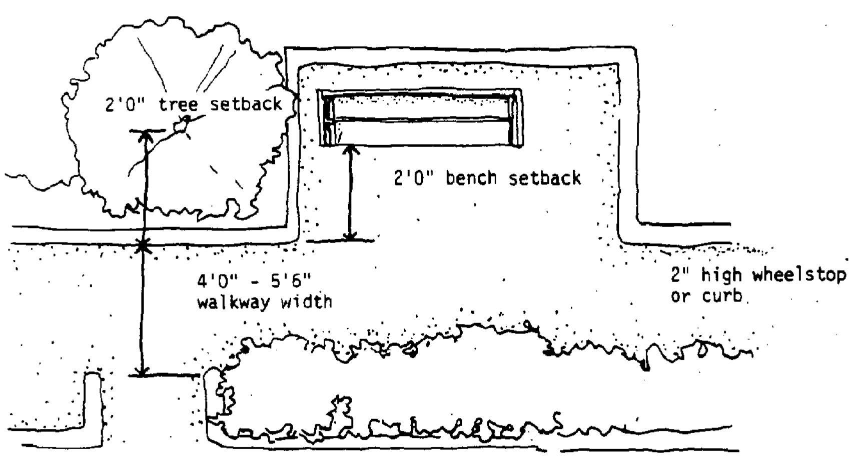
Debris and obstructions should be regularly removed from walkways. Benches, tables, and rest areas should be provided where walkways function as promenades. Benches and tables should be adjacent to, not on, the walkway, to avoid obstructing the path. Benches and tables should have adequate clearance for the maneuvering of wheelchairs.

Gradients

Hard-surfaced walkways ideally should have a slope no greater than 5% (1:20), to allow access for the disabled. (The average wheelchair user can independently negotiate slopes of up to 5%.) Any sustained grades should have level landings at least 5 feet in length at intervals of no more than 400 feet apart. Where the gradient of any walkway exceeds 5%, it should comply with the design recommendations regarding ramps.

Width

Minimum recommended width of walkways is 48 inches or in areas of heavy use, 6 feet or greater. When local conditions make a 48-inch path unreasonable, the minimum unobstructed width should be 38 inches if the walkway is adjacent to a curb or 32 inches if the walkway is not adjacent to a curb.



WALKWAY DIMENSIONS

Cross-Slope

To provide drainage of walkway surfaces, the cross-slope of the walkway should be slightly pitched. Because walkways with an excessive cross-slope can be difficult to negotiate for those in wheelchairs, cross-slope should be no greater than 2% (1:50) or 1/4 inch rise per horizontal foot. Where local conditions do not permit a 2% cross-slope, it should not exceed 4.2% or 1/2 inch per foot for more than 20 feet of horizontal run.

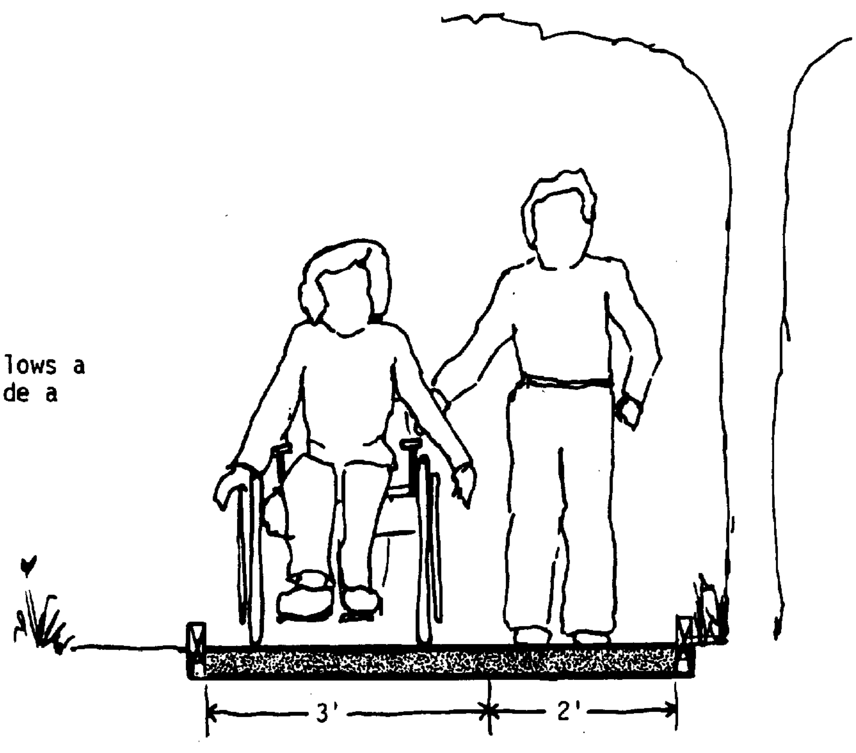
Surfaces

Hard, stable, and smooth walkway surfaces should be non-skid and free of barriers, obstructions, or abrupt changes in level, all of which would restrict access for disabled people. Typical walkway surface materials are concrete, asphalt, asphalt-concrete, and brick. Refer to the Surfaces section for more information.

Wheelstops and Curbs

Wheelstops at rest areas and along the walkway are beneficial for people in wheelchairs. The stops, located at the edges and ends of walkways, provide a secure resting point and can prevent wheelchairs from inadvertently rolling into hazardous areas. Wheelstop height should be 3 inches, plus or minus 1 inch, with breaks located every 5 to 10 feet to allow water to drain.

A 5 foot wide trail allows a person to walk alongside a wheelchair.



Curbs help define the edge of a walkway. Although requiring additional installation expense, they distinguish safe from unsafe areas, prevent vehicles from entering pedestrian areas, and help guide visually disabled people. Curbs that project upwards from a path can be used as wheelstops and can also prevent shifting sands and debris from blowing or washing onto the walkway. However, these curbs can sometimes prevent runoff from sheeting off of the path, and should be broken every 5 to 10 feet to allow drainage as noted.

Curb Ramps

Curbs should not be barriers to disabled access. Curb ramps, briefly described in the ramps section, should be installed where a curb would limit accessibility to the disabled on an otherwise accessible route.

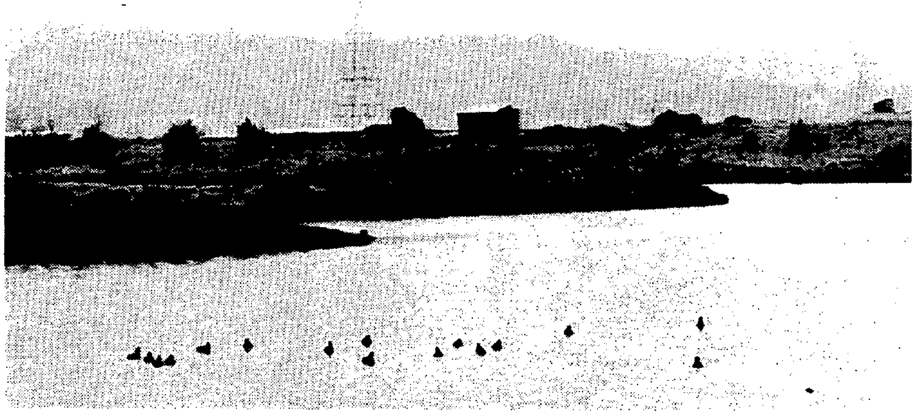
Case Study

ARCATA MARSH TRAILS

The loop trails at Arcata Freshwater Marsh on the shoreline of Humboldt Bay demonstrate a good approach to placing trails on raised dikes. The trails allow visitors to walk the marsh and to watch birds. The trails, which won a Coastal Commission Design Award in 1981, were built by the City of Arcata to provide public access to a 1,400-acre fresh and salt-water marsh within Humboldt Bay. The project involved construction of two loop trails, with support facilities, along existing dikes and landfill areas from which visitors can view the marsh and its wildlife. The project received funding from a Coastal Conservancy Access Grant in August, 1980 and was completed in September, 1981.

Existing facilities at the marsh included a boat launching ramp and a small parking area. Leading from the parking area, 6,000 linear feet of 6-foot-wide redwood-chip-surfaced trails were installed. Along these trails were placed 5 vista points, 6 picnic tables, 6 benches, and trash receptacles. Birdwatching blinds were constructed at each vista point, and large redwood stumps were installed along the shore of the recreation lake for use as "cover" by birdwatchers. Redwood post fences were constructed to keep vehicles off the trails, and a chain-link fence was installed to prevent trespassing and vandalism at a small pumping station facility. Access and interpretive signs were installed.

Considerable construction labor was volunteered by groups, including the Audubon Society, North Coast Environmental Center, and Humboldt State University organizations. While some volunteers were paid a minimum wage for their labor, the total value of both paid and unpaid labor is estimated at approximately $17,000 - a considerable savings.



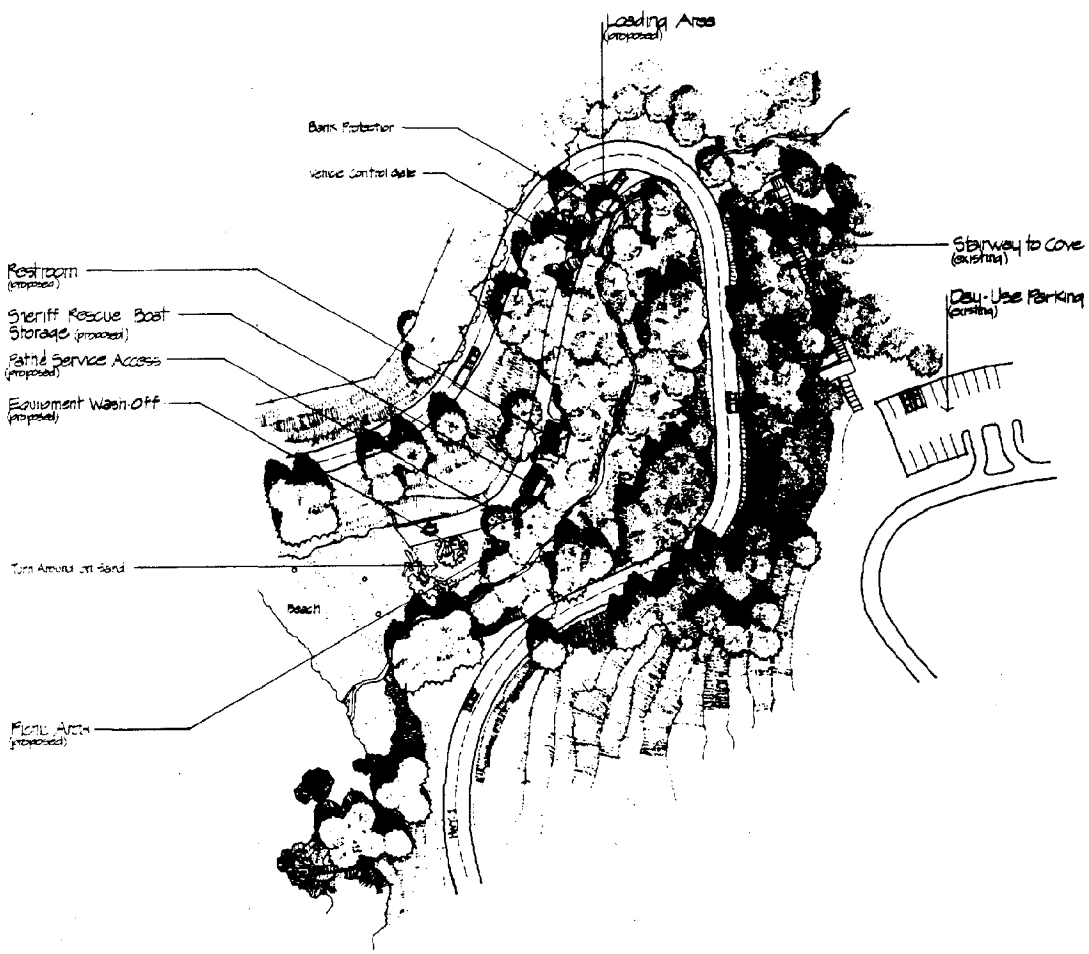
COSTS

<u>Materials:</u>	
Trails ($1.25/foot for batterboards and redwood chips for 6 ft. wide path, 6,000 linear feet long)	$7,500
Signs:	
Access signs	$1,200
Interpretive	$1,200
Benches: (6 @ $75/bench)	$ 450
Tables: (6 @ $200/table)	$1,200
Birdwatching blinds: (5 @ $720 avg./blind)	$3,600
Redwood stumps	$ 400
Redwood post fencing	$1,800
Chain-link fence	$2,200
TOTAL	$19,550
<u>Labor:</u>	
Trail installation labor	$1,675
Other labor for other portions of project	$3,600
TOTAL	$5,275
<u>Funding:</u>	
State Coastal Conservancy grant	$19,500

Case Study

STILLWATER COVE

A hardsurfaced (asphalt-concrete) trail at Stillwater Cove in Sonoma County was designed for beach access that could be used by pedestrians, bicycles, or people in wheelchairs. The Cove is well suited for development of beach access for disabled persons as the drop in elevation from Highway 1 to the water's edge is no more than 15 feet over approximately 1/8 mile. In October, 1979, the Sonoma County Regional Parks received Coastal Conservancy Grant funding to grade and pave a beach path to provide access for the disabled, a vehicle turn-around area on Highway 1, and a picnic area. Funding also provided for installation of four disabled accessible picnic tables and a barrier to prevent motor vehicles from entering onto the path. A Coastal Commission Design Award was presented for this project in November, 1981.



Stillwater Cove, a large, well protected cove within the Sonoma County Park system, is located approximately 90 miles north of San Francisco. The west portion of the cove, popular for diving, fishing, and beach recreation, was formerly only accessible by a dirt path from Highway 1. This project is part of a larger park development, funded by $54,000 in federal Land and Water Conservation fund money, matched by county funds. The new development includes a campground with restrooms and showers, a trail sewage disposal station, a septic field with a sewer connection, and a day use restroom, interpretive displays for disabled users, dressing rooms, and an equipment washoff area for divers.

COSTS

Contract awarded January, 1980 - Completed October, 1980.

Vehicle loading area, grading and paving (2,400 sq.ft. @ $1.40/sq.ft.)	$3,360
Beach path and picnic area grading (3,800 sq.ft. @ $0.30/sq.ft.)	1,140
Beach path and picnic area paving (3,800 sq.ft. @ 0.90/sq.ft.)	3,420
Beach path vehicle barrier and gate, installed	700
Total Conservancy Coastal Access Grant Award	$8,620

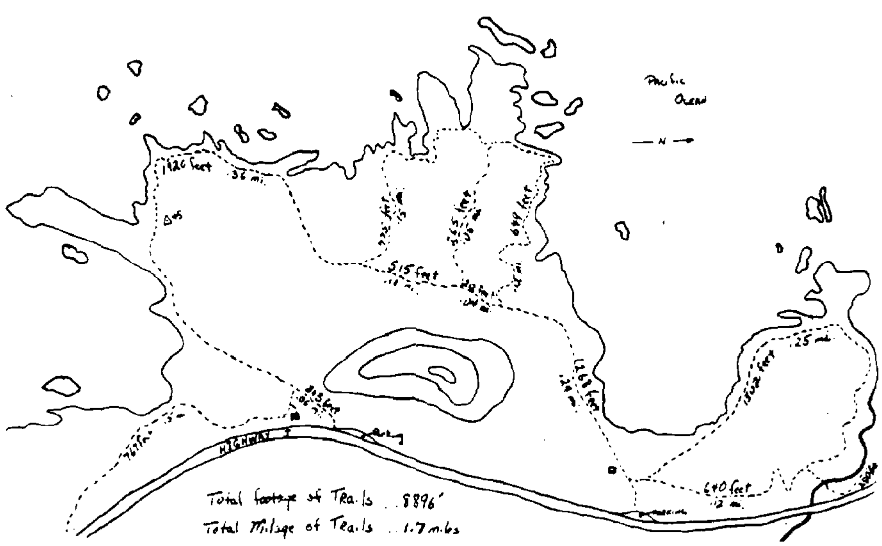
Case Study

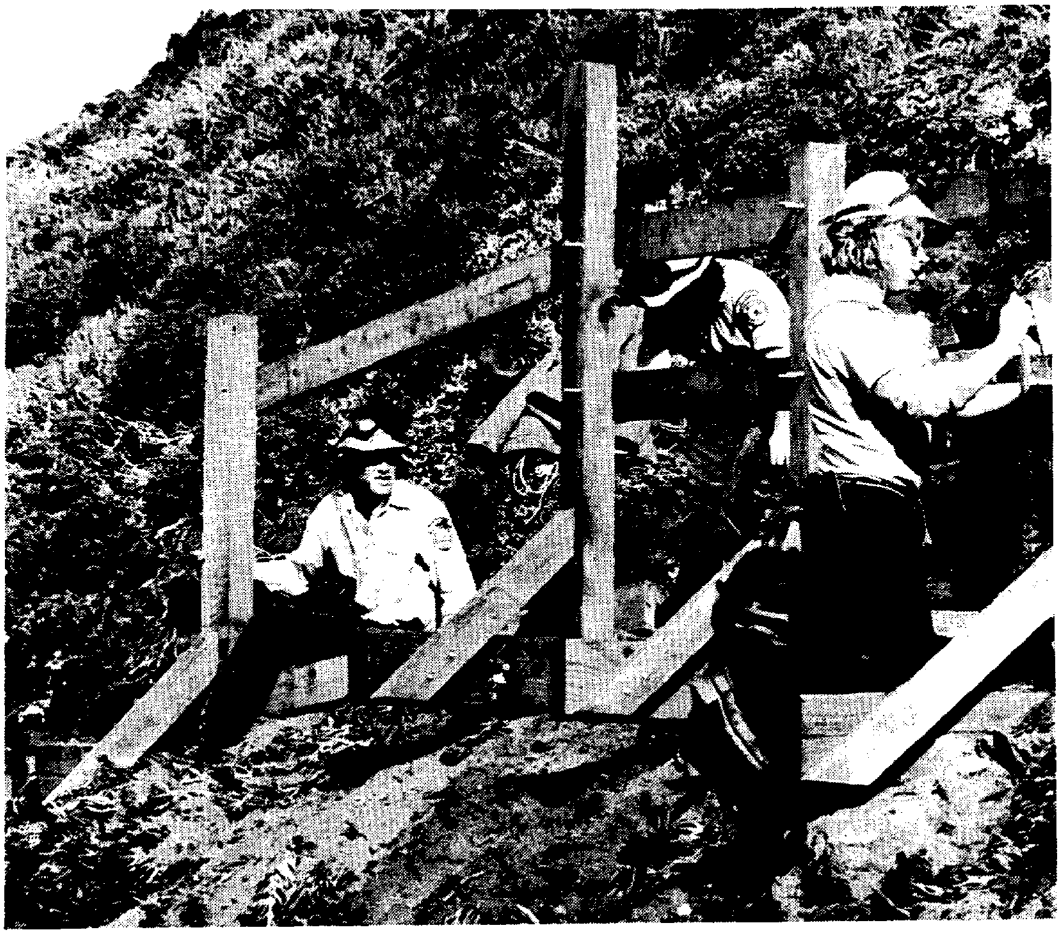
GARRAPATA STATE BEACH

Use of low-cost minimal facilities opened Garrapata State Beach on the Big Sur coast of Monterey County for limited public access in record time. In May of 1981, the California Department of Parks and Recreation agreed to develop five state park units including Garrapata State Beach at Soberanes Point under the new joint Coastal Conservancy/Coastal Commission Immediate Public Use Program. Planning and budgetary constraints typically cause a delay of up to 6 years between the acquisition of State Park land and its development with facilities.

The Soberanes Point area, located on the northern Big Sur coast, was opened to public access within 6 months of the agreement by state parks. Facilities installed included: between 160 and 175 lineal feet of fencing to exclude visitors from hazardous areas (stranded, single cable fence, strung between posts); an approximately 80 foot long by 4 foot wide safety bridge and railing; 36 state park signs; 2 self contained, composting toilets; 2 trash cans; and improvement or construction of 1.7 miles (8,896 lineal feet) of trails. A Coastal Conservancy grant paid for most of the materials for the above facilities, plus Parks and Recreation staff supervision of the work crews. Nearly all labor was provided by an 8 to 10 member California Conservation Corps crew that installed the facilities in 17 days.

The 70-acre blufftop area is well used as it is the only publicly accessible coastline for a 20 mile stretch in Big Sur between Point Lobos and Andrew Molera State Park. Maintenance has been minor; only a few small sections of trail have washed out. The popularity of the area may require installation of additional toilets. Future improvements include installation of additional trails, environmental campsites, and off-road parking.





COSTS

36 state park signs	$ 407
Lumber, cable, and misc. hardware for fencing, safety bridge, and rails	872
2 self-contained, composting toilets	1,240
2 trash cans	24
State Parks work crew supervisor (25 days @ $9.95/hour)	1,990
TOTAL	$4,533

2 to 3 Coastal Access signs installed by Caltrans and posts for the cable strand fence are not included in the above costs.

Funding:

Coastal Conservancy Grant (Original estimate of materials for projects was $3,770)	$3,800

RAMPS

Ramps at coastal accessways are designed for three distinct uses. Curb-ramps provide disabled access over abrupt changes in surface levels, and should be installed where any curb is on an otherwise accessible route. Pedestrian and wheelchair-ramps are wider, longer, and more gradual than curb ramps and can be used in lieu of stairways where slope gradients are not excessive. Both types of ramps can provide access for disabled persons. Boat ramps, constructed for the purpose of launching boats from vehicles with trailers, are not discussed in this manual.

Where steps are undesirable, pedestrian ramps should be constructed. Ramps can provide access for the disabled to the shoreline and to facilities such as restrooms or viewing platforms that are at a different elevation than adjoining walkways, trails, or parking lots. Pedestrian ramps can also be used in place of stairs on steep slopes where erosion regularly damages the accessway, making repair and replacement of a staircase too expensive. Wide ramps can give access to shorelines where vehicle access is important in case of emergencies.

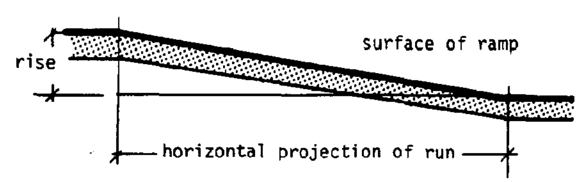
Accessways which have slopes between 5% and 12%, other than stairs or unsurfaced trails, should be designed as pedestrian ramps. Where the slope of an accessway is between 12% and 30%, ramps, stairs, trails, or any combination thereof may be constructed. Stairs should be installed on accessways with gradients greater than 30%.

Gradients and Run

Ramp gradients should be the minimum possible. Most people can comfortably negotiate grades up to 15% (1:6.7); grades greater than 15% are steep, difficult to climb, and should be used only over short distances. Maximum gradient of any portion of a ramp should not exceed 30% (1:3.3).

RUN DIMENSIONS FOR RAMPS
WITH A RISE OF 30 INCHES

slope	run
1:12	30 ft
1:16	40 ft
1:20	50 ft



RAMP COMPONENTS

Ramps steeper than 10% (1:10) should have non-slip surfaces and handrails.

The maximum grade of any portion of a ramp designed to be used by people with disabilities should not exceed 8.33% (1:12). Wheelchair occupants have difficulty ascending and descending steeper gradients. Ramps accessible to the disabled with gradients up to 8.33% should have a maximum rise of 30 inches and a maximum horizontal run of 30 feet between landings; see table for the maximum rise and run of ramps at other gradients. Landings are not considered in determining the maximum horizontal distance or gradient of a ramp.

Width

Minimum recommended width for ramps is 48 inches.

Cross-Slope

The cross-slope of ramp surfaces should not exceed 2% (1:50). Cross-slopes greater than 2% are difficult to negotiate by people with disabilities.

Surfaces

Ramp surfaces should be hard, non-erodable and non-slip. Typically, ramps are surfaced with concrete or asphalt paving. Unsurfaced ramps tend to have erosion problems. Where ramp surfaces may be slick, the surface material should be textured or lightly grooved. However, surface texturing and grooves should not be so rough that they are barriers to disabled persons. For recommendations on surface materials, refer to the Surfaces section.

Drainage

Rainfall runoff accumulates easily on the wide, impermeable and smooth sloped surfaces typical of ramps. Because the surface material, lack of friction and the uniform slope of the ramp, runoff will flow rapidly down the surface and may cause soil erosion problems where it drains off the accessway along the sides or at the base.

Soil erosion is reduced by construction of rock spillways which disperse and slow the rate of flow at points, like landings, where water drains off the ramp. Any gratings installed on ramp surfaces should not become barriers to people with disabilities and should comply with the recommendations given in the Surfaces section.

Curbs

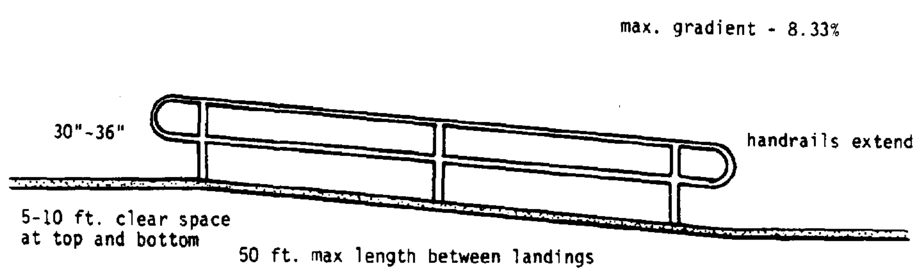
Curbing defines the surface of a ramp or landing and sometimes prevents soil and debris from washing onto an accessway's surface. Curbing provides a tactile edge which can be readily identified by visually impaired users and prevents wheelchair occupants from inadvertently crossing over the edge of the path. Curbing also can be used as a wheelstop at rest points.

Where ramps or landings are adjacent to drop-offs or hazardous areas, curbs, wheelstops, walls, or railings should be provided.

Landings

Level landings should be provided along ramps as rest areas along long gradual climbs. Landings should be at the top and bottom of each ramp run, and should be designed for adequate drainage without excessive cross slope.

Landings should be as wide as the widest ramp leading to the landing, and be at least 48 inches in unobstructed length; intermediate landings should be at least 42 inches long. Any change in direction of a ramp should take place at a level landing. Bottom landings and landings at changes in direction greater than 30 degrees should be at least 72 inches long to provide maneuvering room for wheelchairs. Where a door or gate swings onto any landing, the landing should be at least 60 inches by 60 inches and should extend 24 inches to the strike side of the gate.

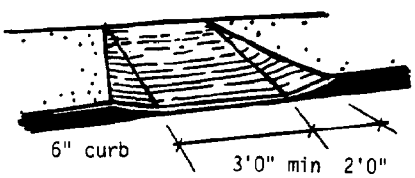


Handrails

Ramps steeper than 10% should have handrails. With the exception of curb ramps to be used by disabled persons, any ramp which has a rise greater than 6 inches or horizontal run greater than 6 feet should have handrails on both sides. Handrails should comply with State Handicapped Regulations, Section 10e, and the guidelines in this manual's section on handrails.

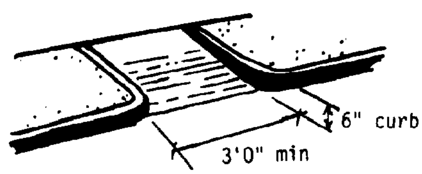
CURB RAMPS

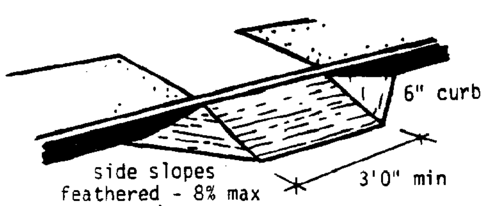
On routes that are accessible to persons with disabilities, curb ramps should be installed at all abrupt changes in grade. This includes grade changes from walks and from sidewalks to buildings or facilities. Curb ramps should comply with State Handicapped Regulations, Section 95.



Flared Ramp - avoid "lip" greater than ½" where ramp meets adjacent paving at top or bottom

Ramp with Continuous Curb - corrugated lines in ramps should be avoided because they hold water





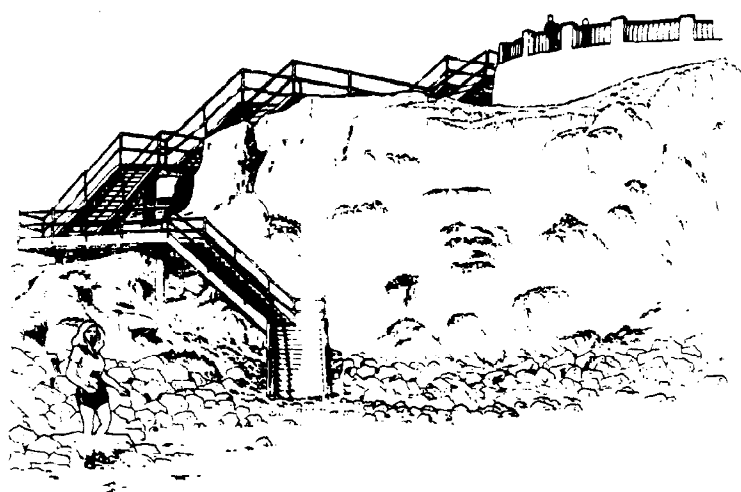
Extended Ramp - use of this type of ramp can interfere with curb and side storm drainage

CURB RAMPS
Source: Barrier-free Site Design, U.S. Dept. of Housing and Urban Development, 1975

STAIRWAYS

Coastal bluffs and hillsides are often too steep for all but the very agile to climb. Steep paths and ramps at these locations may be impractical to construct and fatiguing to climb, and many people will not or can not use them. In these situations, the construction of stairways may be warranted. Stairways are expensive to install and repair, and should therefore be carefully designed to fit the topography of the site. Geological conditions and the vulnerability of the stairway to storm waves and erosion damage must also be considered. Stairways can be constructed as either single-structure staircases, as steps anchored in a slope, or as a combination of both.

STAIRCASES



Staircases are appropriate in the following situations:

- Where the accessway's line of descent will exceed 31% (5:16), but will not exceed 64% (7:11).
- Where erosion or soil stability problems prevent the development of other facilities, such as trails.
- Where an accessway has a long vertical drop.
- Where there is high visitor use of a steeply sloped area.

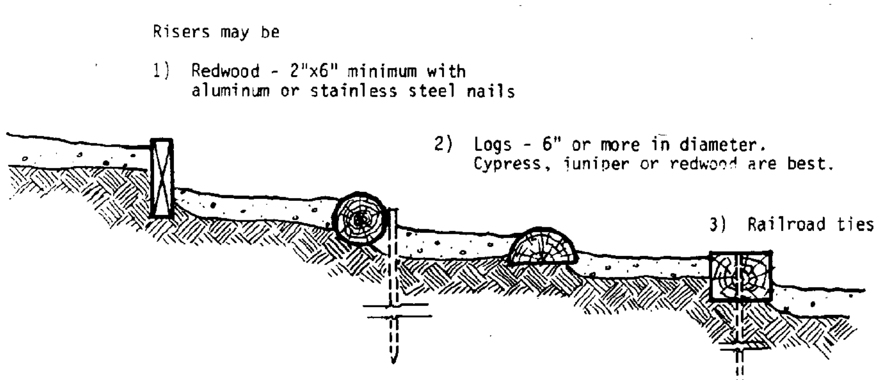
Staircases are most frequently and successfully built with straight wooden flights, supported on pilings. The lowest flight is sometimes constructed of concrete. Although some staircases along the coast are entirely concrete, these are subject to severe erosion damage that occurs when supporting earth washes out or the bluff and stairway slip. Special designs such as metal staircases, circular staircases (either metal or wood), and ship ladders are also constructed for coastal access, although less frequently than concrete or wood structures. Concrete staircases have been most successfully placed on bedrock or stable slopes with short drops and little exposure to runoff or storm wave erosion.

STEPS

Individual steps anchored into a slope can be an economical alternative to a staircase. They are appropriate in the following situations:

- Where an accessway's line of descent is too steep for a continuous natural trail or hard surfaced walkway.
- Where soils are relatively stable amd erosion is not a problem.
- Where the terrain is steep for short distances or intermittently.

Steps may be constructed of railroad ties, lumber, stone, prefabricated concrete, or even recycled materials such as old car tires. Because steps can be installed by volunteer labor or organizations such as the Conservation Corps, initial costs can be substantially lower than for installing a staircase. If neighborhood or user groups supply some labor, costs can be reduced even though regular maintenance is necessary.



VARIATIONS OF WOOD AND GRAVEL STEPS

Staircase and Steps Design Criteria

The beach end of a stairway should be located as far back from the shoreline as possible, to maximize the distance which storm waves must travel before reaching the structure. Constructing the stairway parallel to the shoreline along the face of the bluff or hillside, rather than extending the stairway towards the water's edge, will decrease its vulnerability to shoreline erosion and storm-wave damage.

Stairways should not branch unnecessarily or divide midway. Since most stairways are damaged at the lower ends, more than one beach landing increases the likelihood and amount of periodic storm-wave damage, thus increasing maintenance and replacement costs.

Supporting columns and the lower end of stairways should be protected from, or be capable of safely absorbing, impacts from storm waves or floating debris dashed against the structure.

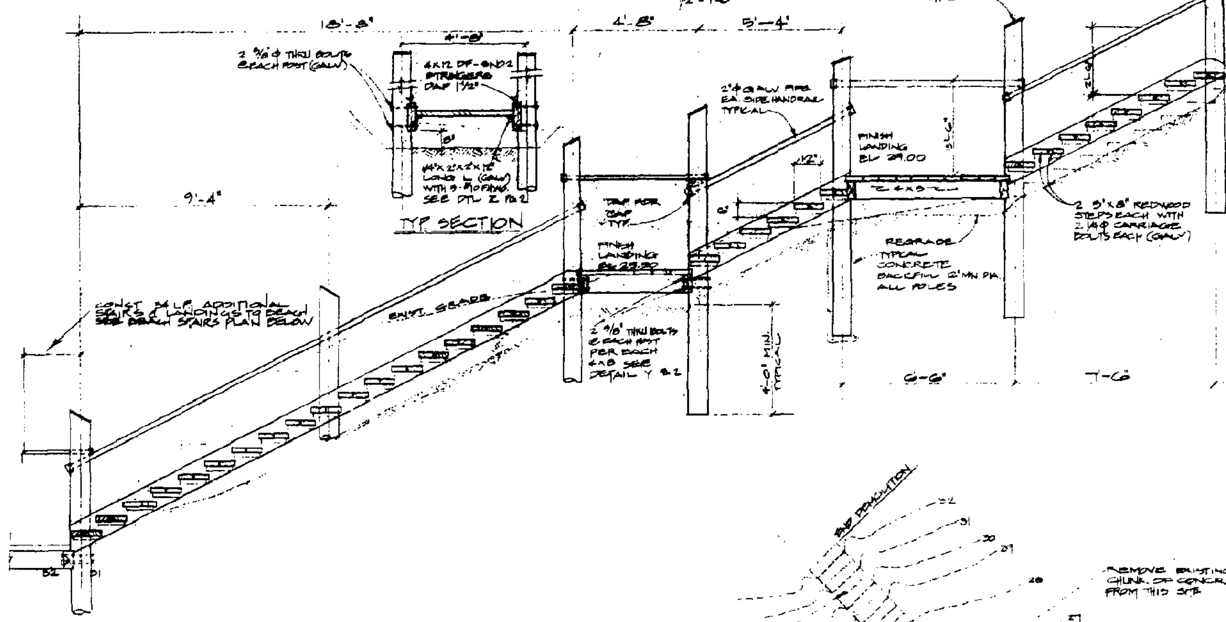
Staircase foundations should extend well below the lowest expected seasonal beach elevation or beach scour line. Frequently damage to staircases occurs when beaches erode below the foundation or anchoring point of the structure, causing the foundation to shift and the accessway to lose its support.

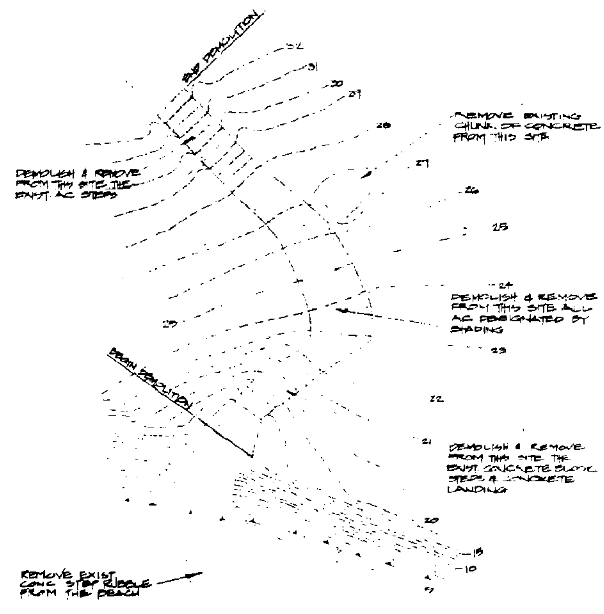
Stairway pilings at bluff faces should extend as deep into the bluff (preferably into bedrock) as is economically possible, to prevent movement of the accessway in the event of bluff erosion.

Photo shows failed concrete steps at Camino Majorca. These steps were removed in 1981, and are being replaced with wooden stairs. Plans on facing page show details for new stairs.

LONGITUDINAL SECTION

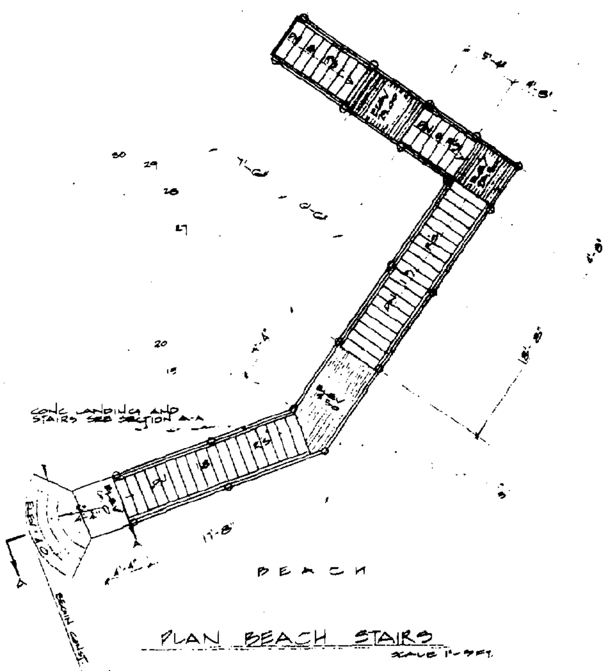
1/2" = 1'-0"





DEMOLITION PLAN

SCALE 1" = 5FT.



PLAN BEACH STAIRS

SCALE 1" = 5FT.

COUNTY OF SANTA BARBARA — STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

REVISIONS	ROADS END STAIRWAY ISLA VISTA
	DEMOLITION PLAN – CONST. PLAN, SECTION, DETAILS
SHEET NO. ONE of 2 SHEETS	DRAWN BY ABM — APPROVED —; CHECKED BY HOWARD — APPROVED —; DATE JUNE 1976 — DATE —

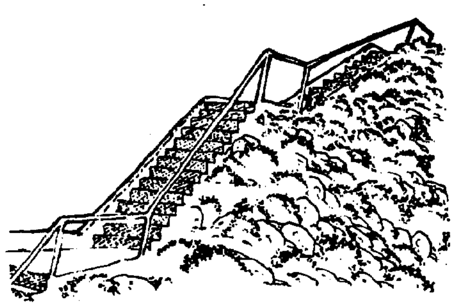
Stairway costs are directly related to length and can be reduced when site conditions permit substituting paths, ramps, or steps for staircase sections, especially at the ends or middle of an accessway. Near the shoreline where storm-wave damage and erosion are most severe and where accessways are most frequently damaged, substituting paths for stairs allows easier and less expensive repairs. Other alternatives for the beach ends of stairways include installation of sections which are retractable or removable during winter storm activity or the construction of an inexpensive section of replaceable steps.

To protect against slope failure, drainage runoff must be prevented from entering the bluff face or hillside adjacent to a stairway. Where surfaced areas such as paths, parking lots, street ends or playgrounds drain onto the bluff, or where existing drainage systems have failed, water can enter bluffs and increase slope failures. If seepage occurs along the face of a bluff, tile drains installed around the head of a stairway will help drain and stabilize the slope. Stairways should not be built in natural drainages where runoff periodically flows.

Treads and Risers

The size relationship between the stair tread and riser is an important safety consideration in stair design. Certain tread-to-riser ratios are comfortable to walk on and deviation from these ratios can make a stairway awkward to use and hazardous. At some steep locations, the temptation to reduce costs and structure size by building an overly steep stairway will create a hazardous accessway. In the City of Pismo Beach a beach staircase was closed to use and replacement planned, at considerable expense, partially because the overly steep tread-to-riser ratio caused safety and liability problems.

The scale of steps outdoors is significantly different than those indoors. Tread depth should be larger; risers smaller. Outdoor stairs designed to indoor requirements and regulations are frequently too steep and dangerous, especially in wet conditions.

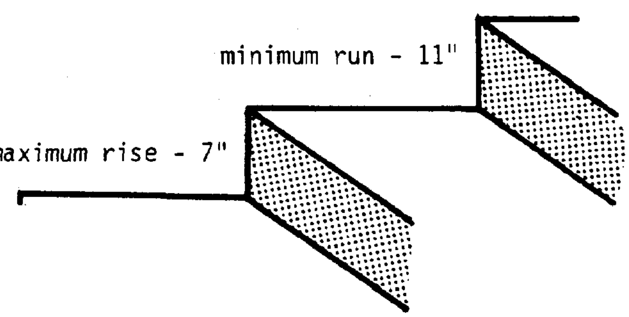


combinations that work best for outdoor steps

rise	run
4"	19"
4½"	18"
5"	17"
5½"	16"
6½"	13"
7"	11"

For any outdoor stairway, risers should not be less than 4 inches nor greater than 7 inches; tread depth should not be less than 11 inches measured from riser to riser. Treads and risers should be uniform for any given flight of stairs; variations in tread and riser size within a flight of stairs can be unexpected and hazardous. Unavoidable changes in tread and riser dimensions should be separated by landings.

Treads should be of non-slip material and designed to drain water off the surface. The cross-slope should not be excessive - a 1/8-inch drop between risers is usually adequate.



Tread nosings should be rounded or beveled to prevent the catching of leg braces and other walking devices. Nosings should not extend more than 1-1/2 inch from the riser, and should not exceed 1/2 inch in radius of curvature at the tread's leading edge.

Stairways should be built with tread-to-riser ratios greater than 64% only where site conditions eliminate all other possibilities. Occasionally, rung or step ladders have been used in locations that would have required a tread-to-riser ratio of greater than 64%. However, these are steep, difficult to climb, hazardous, and are generally not recommended for public use. The issues of safety and liability should be carefully considered when providing accessways with these gradients.

Width

Minimum recommended width for stairways is 3 feet. Where stairs will be heavily used, the width should be increased.

Landings and Stair Flights

On stairways with a significant elevation change, landings provide level rest areas and break the monotony. Ideally, landings should be provided every 6 to 8 feet of elevation change. On long stairways, this interval may be less.

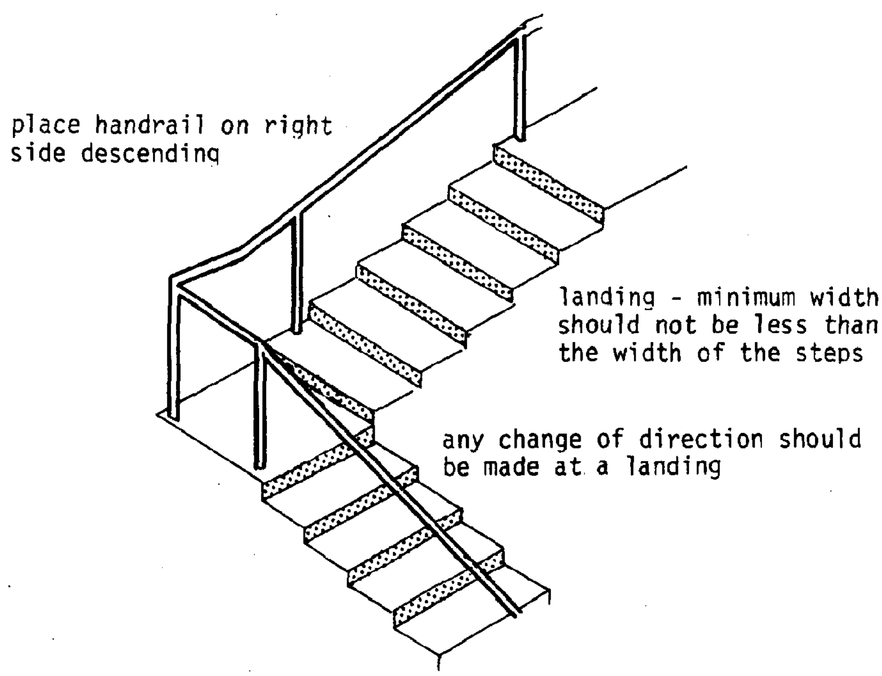
Landings and approaches should be almost level, with only a slight cross-slope (not more than 2%) to allow for drainage. Each landing should have a tactile cue or contrasting color to warn the visually disabled of its presence. The recommended length of landings is 44 inches, or the width of the stairway, whichever is greater. Landings should always be at least as wide as the stairway flights.

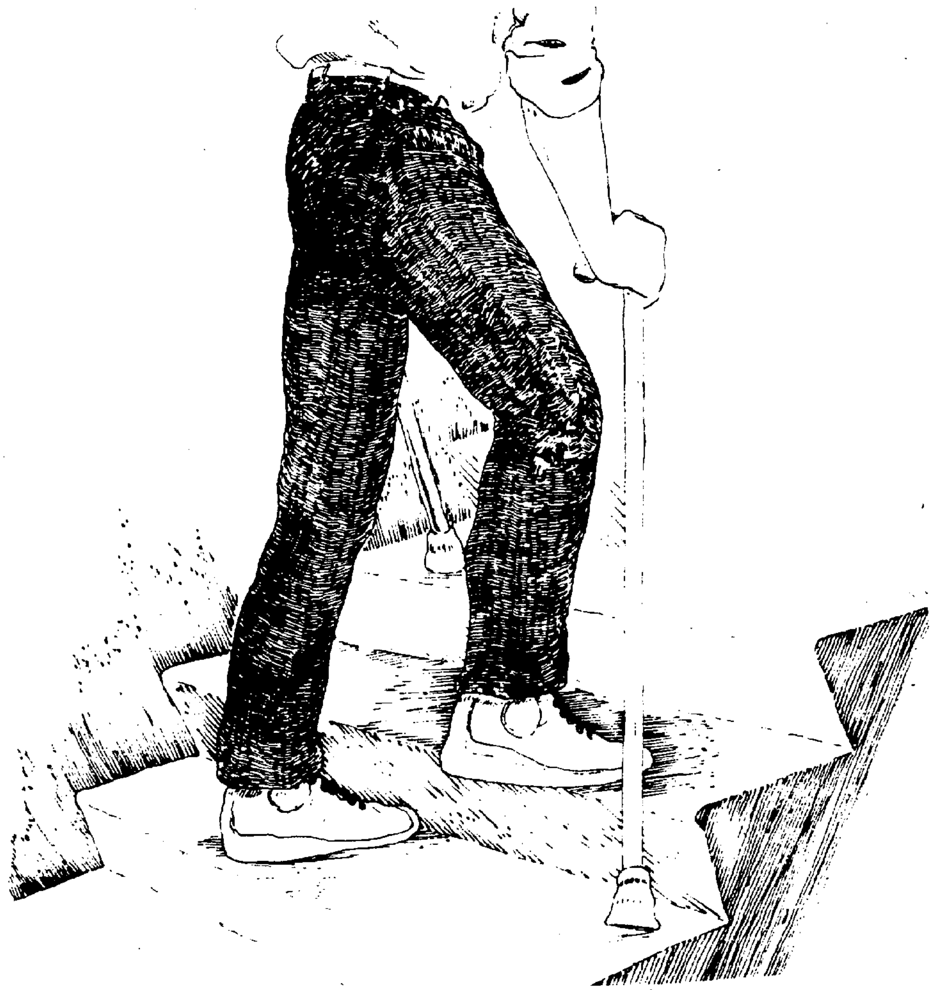
When steps are used in combination with paths and ramps, the steps should be clustered, wherever possible. A short series of steps is hazardous, unexpected and often unnecessary.

Any changes in the direction of a stairway should be made at landings, except for spiral type staircases where the change in direction is constant and uniform.

Handrails

Continuous handrails, conforming to the recommendations in the Handrails section, should be provided along both sides of stairways. They should also be placed along one or both sides of steps, as site conditions require.





Disabled Access

Providing coastal access to persons with disabilities should extend beyond consideration of those in wheelchairs. For some disabled persons, including those with artificial limbs or poor balance, walking up stairs may be easier than climbing ramps. State standards for access to the disabled provide guidelines for stairways. Gradients should not be steep; treads should be no less than 11 inches deep and risers no greater than 7 inches high. Tread nosings should be rounded. Handrails should be easy to grasp, should extend beyond the top and bottom flight of stairs and should be placed on both sides to assist those with strength or mobility in only one arm. Frequent landings and rest areas should be provided if a stairway is long or fatiguing.

Case Study

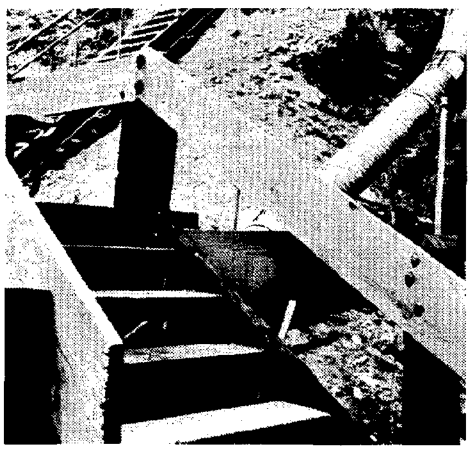
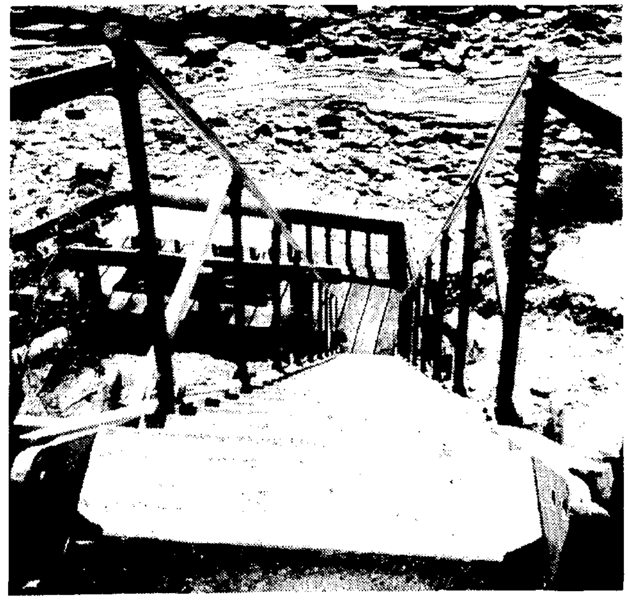
POINT FERMIN TRAILS

The staircase at Point Fermin Trails is an innovative design combining wooden steps with an aluminum ship ladder. Point Fermin Park, located at the Southern end of Palos Verdes Peninsula in the City of Los Angeles provides grassy areas, restroom facilities and picnic grounds. Improved trails traverse the face of the bluff and formerly extended to the beach below. Over the years, some of the trails were destroyed and lower segments officially closed. Two of the deteriorated trails were reconstructed using Coastal Energy Impact Program funds awarded by the Conservancy July 10, 1980.

The western trail, which was approximately 450 feet long, was improved by grading an existing dirt trail and installing steps made of railroad ties.

The central trail, approximately 250 feet long, was paved for the 100 feet near the top, then stairs constructed near the lower end. A wooden stair constructed of 2X4s and 12" diameter cut off poles drops approximately 30 feet, then an aluminum stairway was connected that dropped an additional 26 feet over the 32' horizontal distance. The aluminum stair was an old shipladder purchased by the City.

Minor drainage improvements in both trails, as well as the improvements to the trails themselves, should reduce erosion that was occurring at the site.

COSTS

The following costs were the amounts estimated at the time of the grant award to the City. Final cost estimates were still being compiled at time of publication.

	Western Trail	Central Trail	Total
Engineering Plans	$ 3,500	$ 8,500	$12,000
Survey	600	700	1,300
Construction:			
grade existing dirt trail and install RR tie steps	9,000		9,000
pave 100 ft. long X 6 ft. wide segment at upper end of trail		7,000	7,000
provide and install hinged ship gangway		5,000	5,000
construct wooden stairway from lower end of improved trail to beach		27,000	27,000
Construction Inspection	1,400	5,500	6,900
TOTAL	$14,500	$53,700	$68,200

Conservancy funds provided - $32,200
Construction costs reduced by Conservation Corp labor - $8,750

Original contract date 4/10/81 completed by 6/30/82

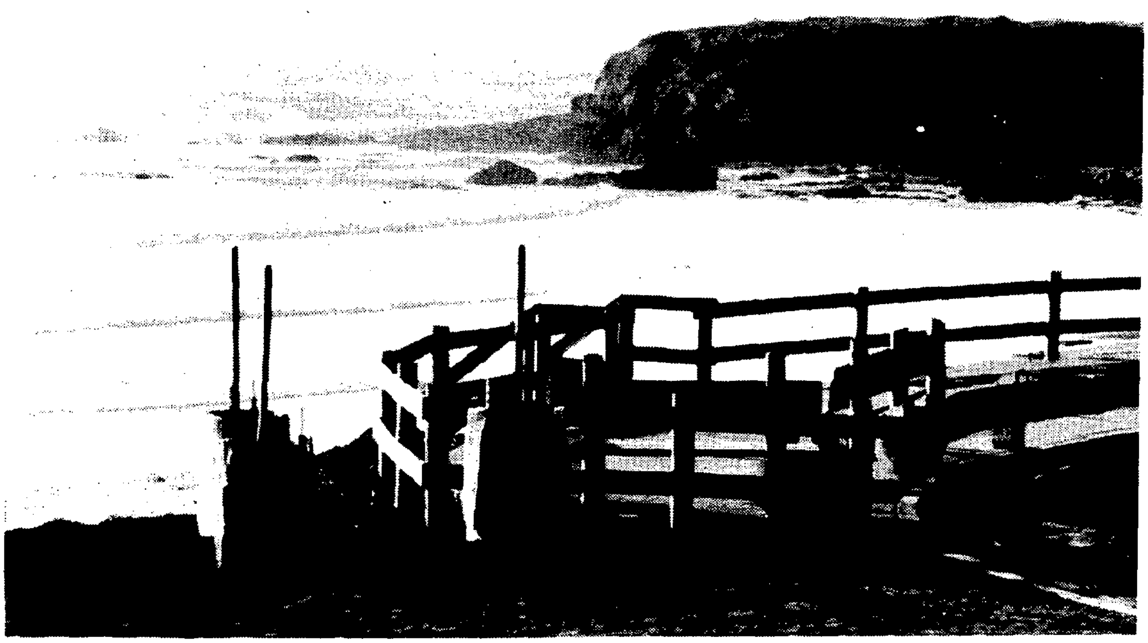
Case Study

SAN SIMEON STAIRWAY

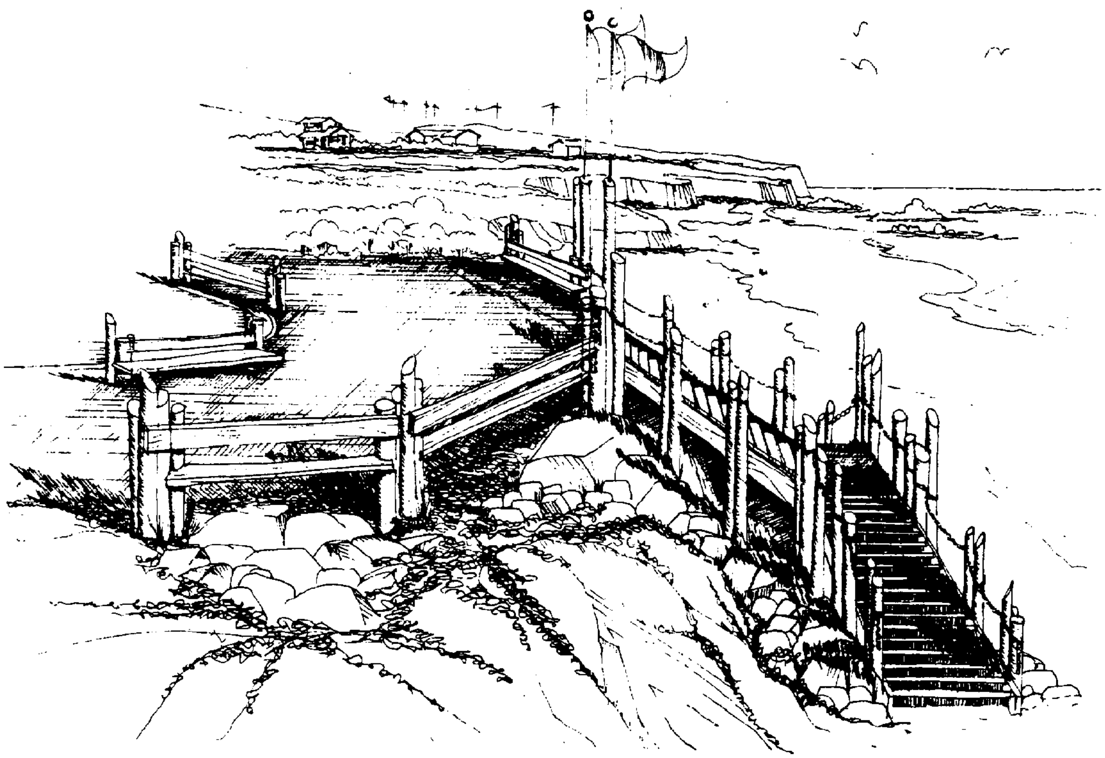
The San Simeon Acres view overlook and stairway, located four miles south of the entrance to Hearst Castle in San Luis Obispo County, were completed in October, 1980. The site is a cul-de-sac at the end of Pico Avenue, formerly Ruta Lane, and is within 100 yards of Highway 1. Owned by the San Simeon Acres Community Services District, the accessway is a portion of a large beach access and landscaping project undertaken jointly by the services district and the county. Before installation of the steps, the beach was accessible only by a dangerous eroded trail which descended approximately 15 feet down the bluff from the cul-de-sac.

The Coastal Conservancy awarded a grant to the District in October, 1979 for the construction and landscaping of a viewing platform, benches and a short stairway to the beach. The platform and stairs, constructed of concrete and wood, encourage use of the beach by providing a safe accessway while protecting the bluff from further erosion. The platform provides a view of the beach from a blufftop vantage point.

The original design called for stairs that branched at the base end, in order to accommodate an existing storm drain in the bluff. This was modified to a single flight, thus helping minimize cost and reduce the potential of storm damage to the stairway near the beach, its most vulnerable point.



Despite these modifications, the base of the stairway was undermined during the winter of 1981. Storm waves, which actually washed up on the stairway's first and second landings, severly eroded the beach beneath the foundation. Repairs included excavation beneath the foundation and the addition of poured concrete to extend the foundation below the beaches scour line down to bedrock.



COSTS

Viewing platform and stairway improvements -	$30,000
TOTAL -	$67,000

Funding:

From Conservancy grant funds -	$15,000
County revenue sharing funds -	$52,000
Repair work in 1981 to repair undermining of landing by buttressing the perimeter of landing with reinforced concrete -	$ 640

BOARDWALKS

Boardwalks provide access to and over areas which are fragile or otherwise unsuitable for the construction of trails, walkways, or ramps. For example, unconsolidated sand dunes may provide inadequate stability for some access facilities; the natural drainage of wetland areas may be altered by construction of trails or walkways. Construction of boardwalks, especially those supported on columns or pilings, will protect these areas while allowing access.

Boardwalks are also constructed to provide access for people in wheelchairs over sandy beaches and dunes. These boardwalks are usually placed directly on the sand, and are sometimes designed to be removed during strom periods. Portable boardwalk designs include ones which are flexible and can be rolled up, or are built in short manageable sections that are linked together during installation. Low-cost boardwalks have been constructed of many innovative materials, such as fencing or wide conveyor belts.

Boardwalk Design Criteria

Construction materials for boardwalks should be resistant to decay and rot. Unfinished boardwalks are preferable; painted or otherwise finished surfaces wear easily and require regular maintenance.

Where boardwalks cross unstable, wet or fragile areas, they should be elevated and supported on columns or pilings.

Windblown sand tends to accumulate under boardwalks, preventing air circulation and proper water drainage, eventually resulting in accelerated rot or decay of the structure.

In some areas, accumulation of sand under boardwalks has been reduced by regular grading of beaches by mechanical graders. This expensive practice is generally only practical at heavily used wide sandy beaches. It may be necessary at other beaches to have maintenance people periodically dig accumulated sand from beneath boardwalks.

Where flexible boardwalks, designed primarily for use by disabled persons, are placed directly on the sand of dunes or beaches, the surface gradient should be smooth or gently undulating. If necessary, the sand should be lightly graded to smooth wind-created ridges, ripples, or other sharp changes in terrain.

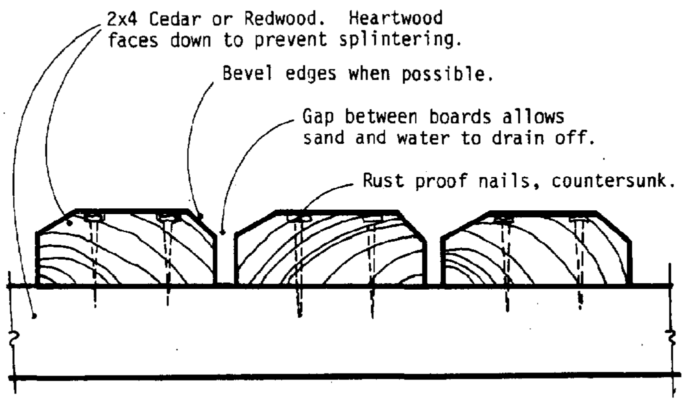
All boardwalk surfaces should be free of steps and flush with adjoining walkways and paths. There are few situations where boardwalks can not be made accessible to people with disabilities.

Width

Minimum recommended width of boardwalks is 48 inches.

Gradients

Boardwalks are normally constructed with level surfaces. Where the surfaces are sloped, gradients in the direction of travel should not exceed 10% (1:10). Gradients should not exceed 8.33% (1:12) if the facility is to be used by people with disabilities. Boardwalks with gradients above 5% (1:20) are considered ramps and should comply with recommendations for ramps.

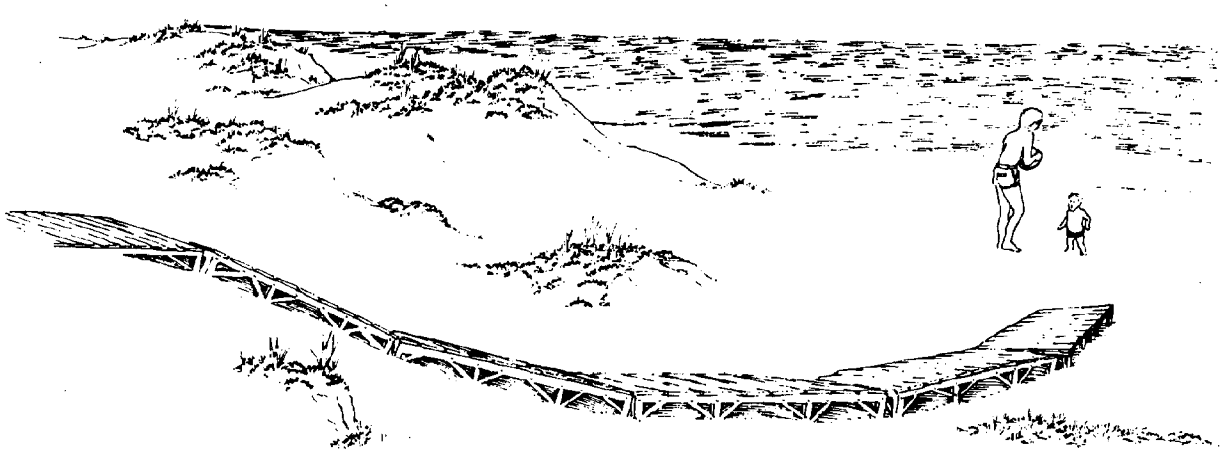


Cross-Slope

Water is normally drained off boardwalks by leaving approximately 1/4 - 1/2" spacing between the surface planks. If a pitched cross-slope is necessary to drain the surface, the slope should not exceed 2% (1:50).

Surfaces

Boardwalk surfaces are normally of unfinished planking. Refer to the Surfaces section.



Case Study

JEWELL LAKE BOARDWALK

The boardwalk constructed by the East Bay Regional Park District at Jewell Lake in Tilden Regional Park in the Berkeley hills provides access to a large number of visitors to a high use marshy nature study area. Care was taken by the EBRPD and by the contractors during construction to avoid disturbing existing vegetation.

Boardwalks such as this require engineered drawings and specifications, particularly to determine the depth of pilings and type of foundations. The fairly complex construction would be difficult to do without previous experience.

The Jewell Lake Boardwalk was built in 1971 with approximately 730 linear feet of boardwalk. Additions were made in 1974 and in 1978 an additional 112 feet were added. The 4 foot wide boardwalk uses pressure treated Douglas Fir Poles, sunk into the marsh area 4 feet, with backfill around the posts. The poles, joists and beams are all pressure treated Douglas Fir. Handrails were constructed of 2X4 for lower rail, spliced only at the posts and connected with counter sunk carriage bolts.

COSTS

Cost information for this particular project would not be particularly useful because it is not current. A similar project was recently proposed for the Hayward Marsh. Although the Hayward Marsh project had piles sunk approximately 24 feet and is 6 ft. 9 in. wide, costs would be similar.

Two boardwalks are being constructed in Hayward - one 537 ft. long, which was bid at $78,866 or $21.76 per square ft., and one 294 ft. long, which was bid at $44,406 or $22.38 per square ft.

Case Study

ANO NUEVO STATE RESERVE

In 1981, the State Department of Parks and Recreation at Any Nuevo State Reserve in San Mateo County installed a wheelchair accessible trail over the sand dunes at Ano Nuevo Point. Using this 300-yard long trail, visitors, including those with disabiities, reach a viewing platform that overlooks an elephant seal breeding ground.

The unusually low cost trail is constructed using old conveyor belts that were donated by local rock quarry companies. The belts, which are periodically changed by the quarry companies, vary in size and thickness. At Ano Nuevo, a 3/8 inch average thickness was best because it was heavy enough to stay in place, yet light enough to be rolled up and carried. The belts were cut into 12 to 18 foot sections and holes drilled along each side through which hay hooks could be attached to help in dragging the belts into place. Small belt sections were placed along the trail for use as turn-around and passing areas. Some wheelchair users find the 3 foot average trail width at Ano Nuevo too narrow.

Prior to laying the belts over the dunes, the sand is graded to provide a smooth surface by dragging a section of rolled up chain-link fence over the route of the trail. Belt sections are then layed into place with the belt ends overlapping such that the exposed end, or lip, of a belt is not an obstruction in the direction of uphill travel. No anchoring of the belts was necessary since they were heavy enough to stay in place. Where edges of belts curl, the edges are dug slightly into the sand. The belts are rolled up and stored during low visitor use to reduce maintenance problems of keeping the trail clear of drifting sands.

Although the trail has not been formally opened, tests by visitors in both manual and electric wheelchairs found it improved access over the dunes. Initial construction of the trail required approximately 1400 hours of labor, 80% of which was provided by volunteers from the local West Valley Junior College. Labor required for annual re-installation of the trail should be much less. Maintenance requirements are minor, consisting only of occasional clearing the trail of sands.

Case Study

STINSON BEACH BOARDWALK

Wheelchair accessible access has been provided within the Golden Gate National Recreation Area at Stinson Beach in Marin County over soft unconsolidated beach sands by installing a flexible, roll-out wooden boardwalk. The boardwalk can be easily removed and stored during the winter months, thus providing shoreline access without the high costs of repairing winter storm damage.

The boardwalk is constructed of 1" X 1" X 30"oak slats. The slats are attached near their ends to two long narrow rubber belts, similar to the rock quarry conveyor belts used at Ano Nuevo State Reserve. The length of the boardwalk is approximately 50 feet, and when rolled up is heavy enough that it requires at least two people to carry it. When laid out, the boardwalk is staked in place to prevent it from moving. Grading of the sand is usually unnecessary prior to installation.

Although only occasionally used, those people who have tried the boardwalk like it. However, some find the boardwalk's occasional steep gradient (where the boardwalk crosses the beaches berm) difficult to climb.

Construction costs were unknown. Labor costs for installing the boardwalk are minor. Maintenance is also minor, limited primarily to repairing vandalism damage caused by people seeking firewood.

FOOTBRIDGES

Footbridges can be simple wooden structures spanning a narrow creek or they can be elaborate, prefabricated bridges spanning 100 feet or more. They should be constructed where an accessway crosses a year-round or seasonally filled water course, extremely steep channels, or a fragile ecosystem.

Footbridge Design Criteria

Footbridges should be designed so floodwaters and debris do not damage the supports. Within a given watershed large floods may occur at irregular intervals, ranging from seasonal to as seldom as once in 100 years, depending on precipitation patterns and characteristics of the watershed. To reduce the vulnerability of bridges to flood damage, the design should meet one or more of the following criteria:

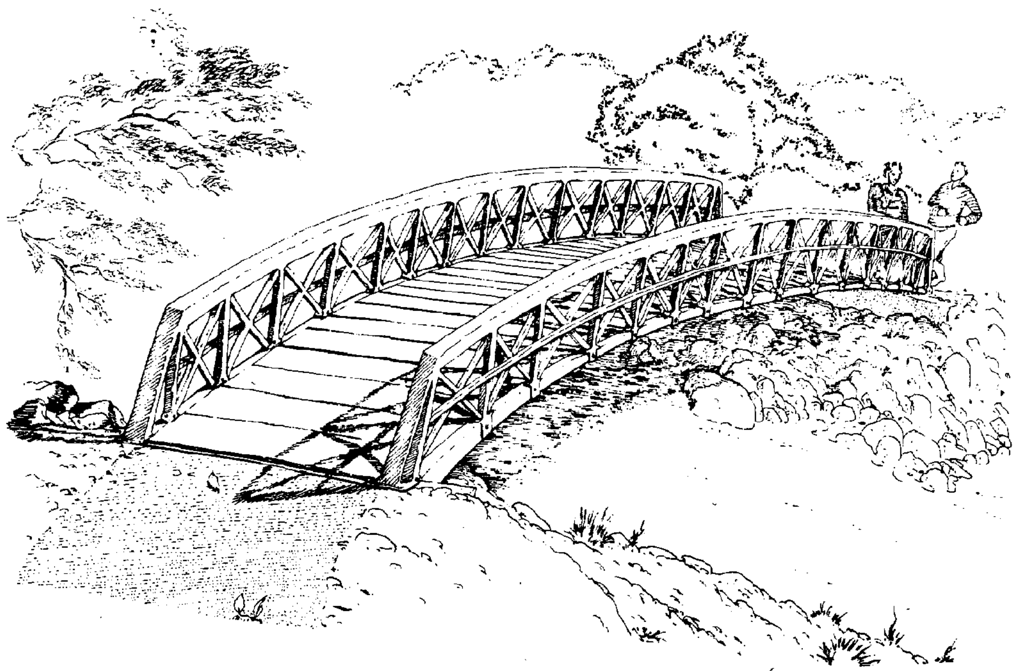
- The bridge, footings, and approaching paths should be located above the high-water level or flood plain.
- The structure should be designed so that removal and storage are possible during high-flood-danger periods.
- The bridge, footings, and handrails should be strong enough to withstand erosion of the stream channel and the build-up and pressure from debris and floodwaters against the structure.
- "Break-away" handrails, which break loose under the pressure of floodwaters or debris buildup, thereby relieving pressure on the bridge, should be installed and designed for easy and economical replacement.

Bridges spanning less than 24 feet can be easily designed and constructed of wood. Bridges can either be custom designed or purchased as a prefabricated unit from companies handling metal bridges or recreation equipment supplies. For spans of over 100 feet, a custom-designed bridge is usually required. Unless the bridge will be used by a large number of people, the cost of such a large span may be unjustifiable.

All footbridges should be routinely checked for structural integrity.

Rigid structures should allow for expansion and contraction with temperature and humidity changes.

Footbridges should be located where the necessary span is shortest. Because the cost of a footbridge is directly related to its span, minimizing the length of the structure can significantly reduce costs.



Surfaces

Footbridges should be designed to prevent water accumulation on walking surfaces. On wooden bridges, this is most commonly done by leaving 1/4 to 1/2 inch gaps between the boards used as a walking surface. Walking surfaces should be stable and non-skid under all weather conditions.

Although wood is the most common material used for footbridge surfaces, metal is also commonly used, especially on prefabricated bridges. Refer to the Surfaces section.

Disabled Access

Footbridges can be made accessible to people with disabilities in all but a few situations. Footbridges should always be accessible on any trail which can be used by the disabled. To provide wheelchair access, surfaces should be free of steps and flush with adjoining walkways and paths.

Width

Footbridges should be as wide as the widest path leading to the bridge. Where this is not practical, minimum width should be 30 inches. Minimum width should be 3 feet if it will be heavily used or used by people in wheelchairs. This width accommodates one wheelchair, but will not allow two wheelchairs to pass.

Handrails

Where footbridges are narrow or potentially hazardous, continuous handrails should be provided on both sides. See the section on Handrails.

Case Study

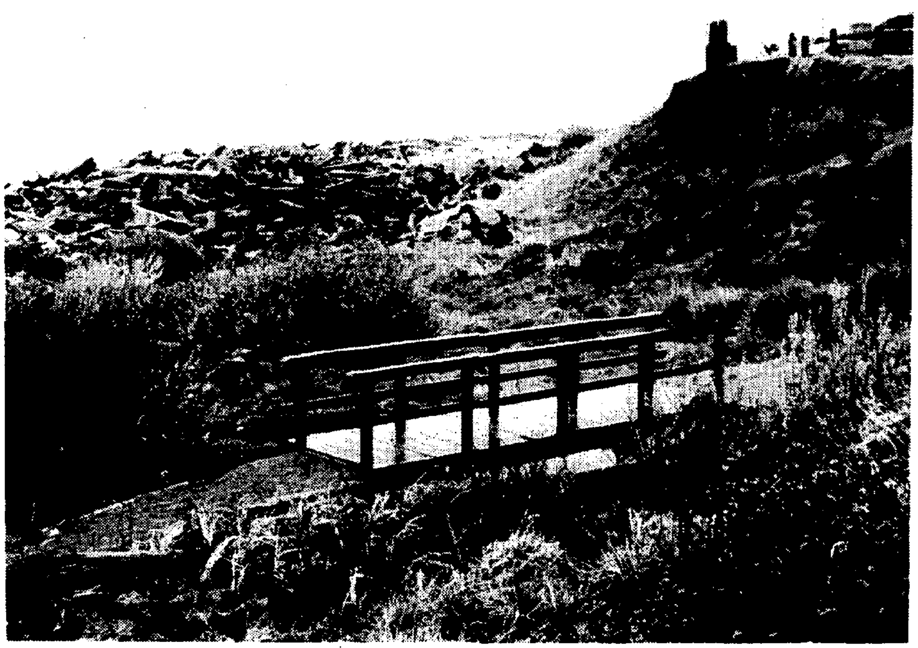
KAMPH MEMORIAL PARK

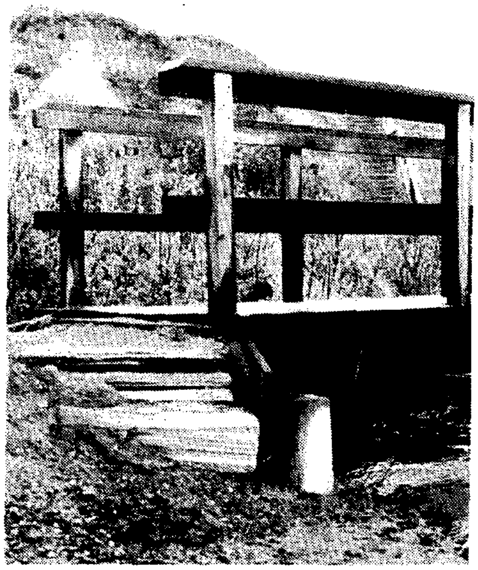
A small bridge in Kamph Memorial Park demonstrates an inexpensive way to traverse a short section of muddy ground and a seasonal stream.

Kamph Memorial County Park is located in northern Del Norte County, immediately off Highway 101 in a rural agricultural area, two miles south of the Oregon border. The small park (200 feet by 425 feet) was deeded to the county in 1956, and renovated and officially dedicated in 1976. The day use area had restroom facilities, picnic tables and trails. Beach access was provided by one formally maintained trail and stairway at the south edge of the park, and a number of "informal trails' down a 25-foot bluff. These informal trails contributed to bluff erosion and the necessity for park improvements.

A Coastal Conservancy grant, awarded to the county in 1979, provided funding for construction of a 250-foot long split rail fence to surround the parking lot, five car barrier "bumpers", an access sign, new steps from the parking lot, and a small footbridge. Three areas of the bluff adjacent to the prking lot were rebuilt, shored and replanted.

The steps are of tamped earth, reinforced with 2 by 10 inch Douglas fir, and wooden stakes sunk approximately 2 feet deep. Washed gravel was used on top of the steps to reduce erosion and drain the treads.





COSTS

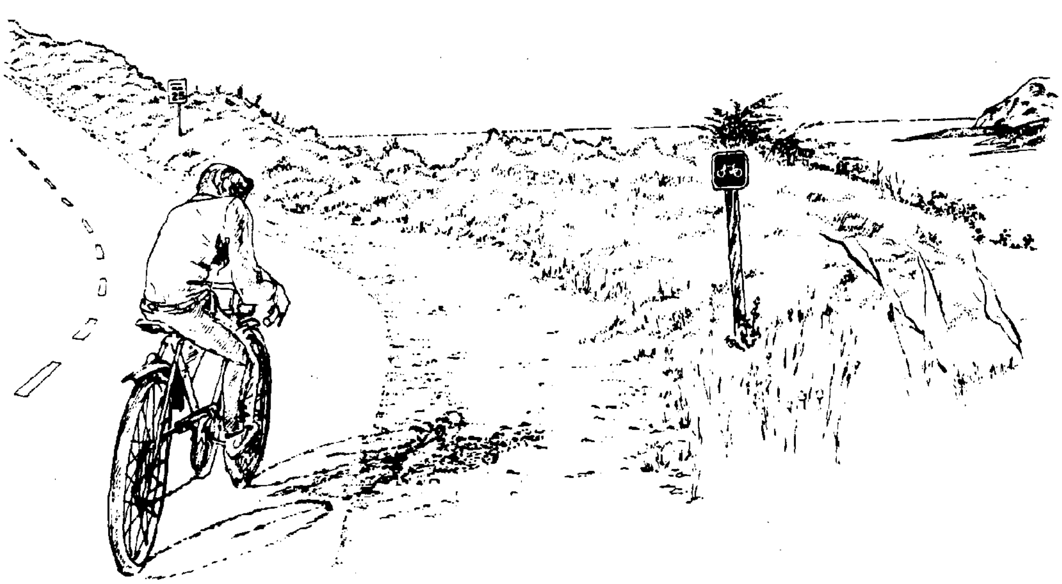
Culvert, stairway, bluff restoration	$1,579
Fencing, bumpers	1,464
Sign placement, shrubs, footbridge	2,015
other materials (epoxy, sign)	98
county administration	810
overhead	630
TOTAL COST	$6,596

Conservancy grant - $6,050

BIKEWAYS

Coastal bikeways are facilities specifically designated to provide access to and along the coast by nonmotorized bicycle travel. Bikeway development ranges from the minimal designation of a Class III bike route to a specifically designed Class I bike path which is separated from any vehicle routes and is provided for the exclusive use of bicycles.

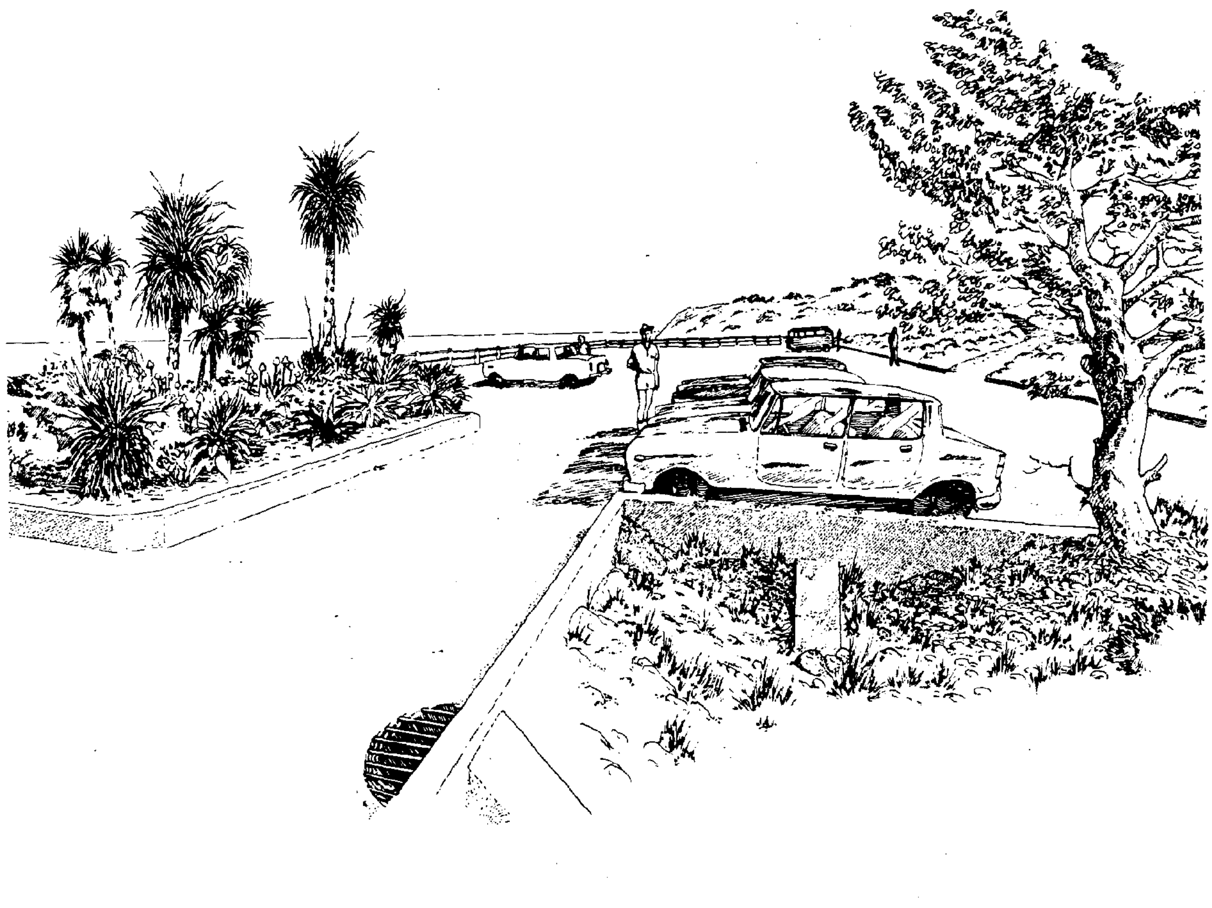
Bikeway design criteria, as mandated by the California Bikeways Act, has been established by the California Department of Transportation. Section 2376 of the Streets and Highways Code requires all local and regional agencies having responsibility for the development of bikeways to comply with "all minimum safety design criteria and uniform specifications and symbols for signs, markers and traffic control devices established by the Department." These criteria and specifications are detailed in the Department of Transportation's publication, Planning and Design Criteria for Bikeways in California, June 30, 1978. (For copies of the above publication, contact: Office Chief, Office of Planning and Design, California Department of Transportation, 1120 N Street, Sacramento, CA 95814.)



SUPPORT FACILITIES

Support facilities add to public enjoyment and ease of maintenance of coastal accessways. They include signs, trash receptacles, public telephones, restrooms, showers, bike security racks, public transit stops, tables and benches, fish cleaning facilities, campgrounds, and parking areas. Design considerations for some of these facilities are included in this section.

Many of these facilities can be purchased and installed by local or regional recreation equipment and public works suppliers, or can be constructed and installed at minimum cost by volunteers or California Conservation Corps members.



PICNIC TABLES AND BENCHES

Where appropriate, picnic tables should be designed for use by people in wheelchairs.

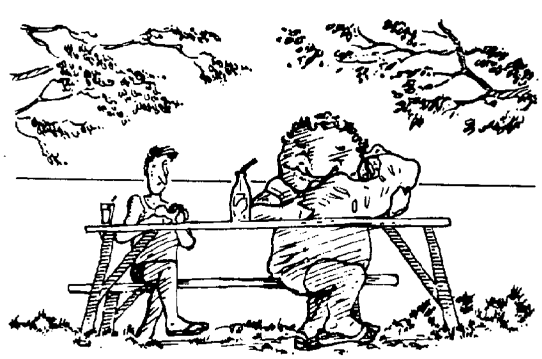
1. Extend the ends of the table to 18 to 25 inches beyond the table legs to provide space for wheelchairs.
2. Provide unobstructed clearance at the ends of tables so that wheelchair armrests can fit underneath. Average armrest height is 30 inches.
3. Provide at least 30 inches of clear width at the end of the table to allow wheelchair maneuvering.
4. The tops of the tables should be between 28 and 34 inches above the ground.
5. Tables should be placed on level, firm sites. Paths, ramps or walkways leading to tables should comply with standards for disabled access.

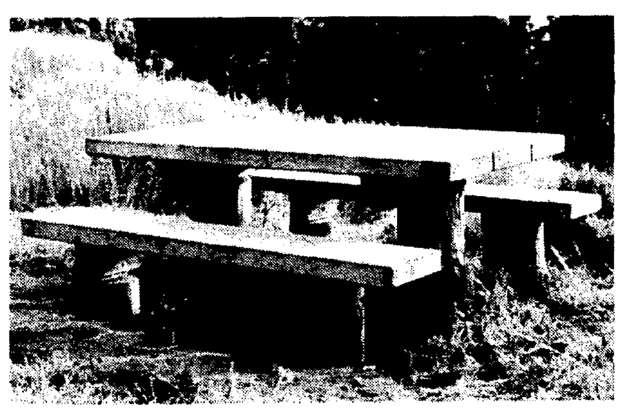
Wooden benches and tables are vulnerable to engraved graffiti and vandalism by firewood seekers. Tables and benches should be located where they provide some privacy to users, but still allow for formal or informal surveillance.

Steel and aluminum benches and tables, available from a number of recreation equipment suppliers, may solve constant vandalism problems, but are generally more expensive and less attractive than wooden facilities. Vandal-resistant benches have been successfully designed and used by the New York City Parks Department. These benches are made of heavy galvanized steel supports with backings and seats made of thick planks of purple heartwood from South America. Purple heartwood, like other expensive hardwoods, is resistant to nearly all vandalism except spray-painted graffiti.

Slope gradient at picnic areas should not exceed 20%. Level, well-drained areas are preferable.

Where possible, picnic areas should have a water supply of 2.5 gallons per person per day or 15 gallons per person per day where flush toilets are provided.





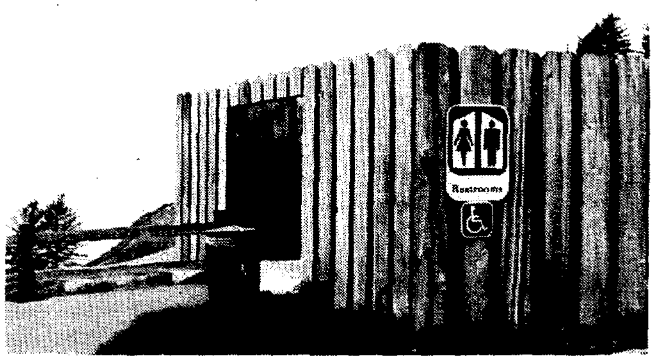
Tables should be located not more than 300 yards from drinking water when it is provided.

Benches with back supports and armrests provide aids for elderly people and those with disabilities in lowering and raising themselves.

Trash receptacles should be nearby any picnic tables or benches; in general, one trash can should be provided for every 4 picnic tables.

All corners of benches and tables should be rounded or beveled.

RESTROOMS



As a general rule, a separate unit for men and women should be provided at an accessway per every 30 parking spaces, 50 people, or any fraction thereof. Undeveloped beaches that are considered part of an "open-space" area do not usually require a toilet facility if beach use is less than 50 people per mile of shoreline; open-space areas are areas where there are no access facilities and no lifeguards or other services.

Restroom facilities should be located as conveniently to an accessway as possible, without placing the restroom in an area which is exposed to shore or bluff erosion or locating it in a sensitive area.

Restroom facilities vary greatly in design. The most common unit is a structure containing, or mounted over, a waste storage tank that must be periodically pumped out and cleaned. Where water hook-ups are available, but sewer hook-ups are not, relatively odorless water-conserving flush systems minimize the amount of waste which must be periodically pumped out.

Also available are "self-contained" waterless restroom facilities. Because these units operate on a system of evaporation and dehydration of waste, they do not require water or sewer hook-ups, and usually do not need to be pumped out. Required maintenance has been reduced to periodic cleaning of the upper structure. Purchase and installation costs are comparable to or only slightly higher than those of conventional systems, but long-range servicing costs are markedly lower. These systems are only available from a single supplier (Shasta Manufacturing Inc., P.O. Box 2243, Redding, CA 96001).

Where accessways are designed, improved, or signed for use by people with disabilities, at least one restroom facility or stall should be accessible to wheelchairs. The facility should comply with state regulations for handicapped access. All walkways, curbs and changes in elevation leading to the facility should be accessible to wheelchairs and comply with the standards for disabled access to ramps and walkways.

Restrooms on or near a beach may be vulnerable to storm wave damage. They should be designed to withstand storm-related damage, or they should be movable.

TRASH RECEPTACLES

Trash receptacles are typically placed in a location convenient for maintenance crews. Along the coast, this is usually at the point where an accessway intersects a road. However, people may neglect to use these trash cans because they are too distant from the beach. Heavily littered beaches may indicate a need to relocate or add trash cans. In the long run, this may be more economical than paying the costs of more frequent beach cleanup.

Research indicates that trash cans which are decorated, noticeable, unique, or easily recognizable are more likely to be used than those which blend with the surroundings.

Engaging or humorous invitations to use trash receptacles are generally preferable to impersonal admonitions. However, direct commands have been tried; an East Coast city now posts signs stating, "Littering is ugly, unhealthy, and costs you tax money to clean it up, so don't do it."

Non-painted, anodized aluminum receptacles tend to attract less graffiti and do not require periodic repainting.

Sand and salt can damage trash receptacles, especially if they are dragged to dump trucks or dumping areas. To increase the longevity of trash receptacles:

1. Holes should be drilled in the bottom of metal cans and bins to allow moisture to drain out.

2. Receptacles should be covered to prevent water from entering.

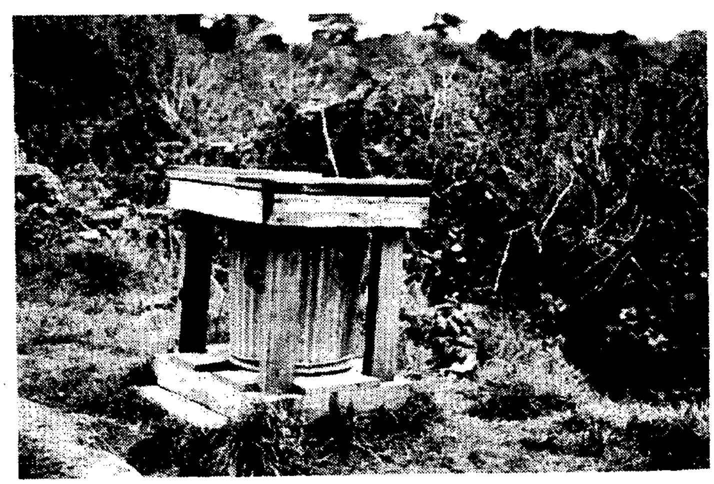
3. Wooden skids should be attached to the bottom of receptacles to reduce wear and keep the can or bin off of alkali ground.

4. Plastic receptacles should be used where corrosion is a problem.

Trash cans should be designed to allow use by persons with disabilities. The receptacle should not be higher than 3 feet. Hinged doors or covers should be easy to open or lift. Spring-loaded doors or foot-operated doors should not be installed.

Trash receptacles should be easy to lift and empty by maintenance crews.

Trash receptacles should be securely anchored. Unsecured trash cans can be knocked over by wind and vandals. At beaches which have inadequate or vandalized picnic tables, people have turned unanchored trash cans over for use as tables, in the process dumping and scattering trash on the

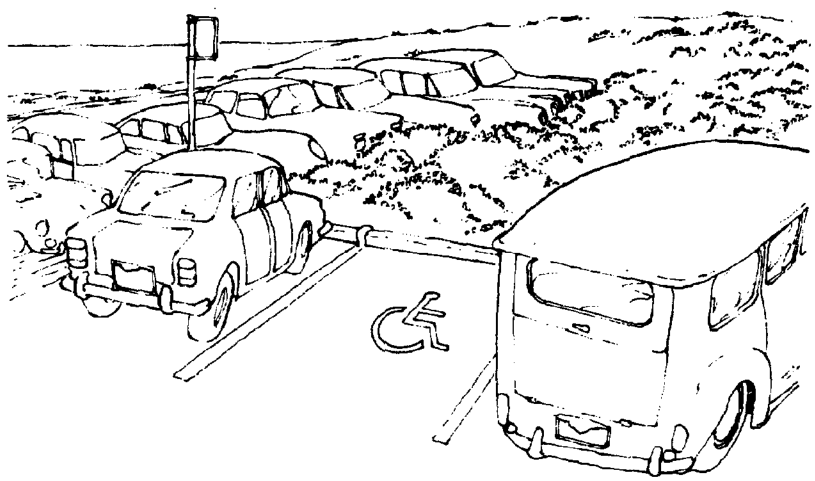


beach. Any form of anchoring should allow maintenance crews to easily detach (unlock if necessary), lift and empty trash receptacles.

Cleanup schedules for beaches should correspond with the periods of heaviest visitor use. Trash cans emptied at the end of busy days can not be dumped out or lit on fire by vandals at night. Also, beach visitors may be encouraged to properly dispose of trash if cleanup operations are observed.

Exposed edges should be rounded or smoothed to protect people from cuts or abrasions.

PARKING AREAS



Where possible, there should be sufficient parking spaces to meet the expected use of an accessway on an average peak-use day. Inadequate parking at accessways may cause parking problems on adjacent highways and streets. The use of accessways can vary dramatically along the coast; to estimate the expected demand at a planned access, compare it to existing nearby accessways which are similar.

Parking areas should be nearly level, with only a slight gradient to provide drainage (1 to 5%). Parking area gradients should never exceed 10%.

Large expanses of asphalt parking areas should be avoided. They are unattractive and may create drainage problems. Large parking areas should be broken up by planter islands or strips.

One of the most significant contributing factors to bluff and accessway erosion is the drainage of runoff from parking areas and streets onto or over the edge of a bluff or down an accessway. Parking areas should be designed so they always drain away from the edge of a bluff and accessway, even during the most severe weather conditions. If drainage from a parking area or street must flow to the edge of a bluff, the flow shold be contained in a controlled channel as it drains over the bluff and down to the beach. Drainage facilities, if installed, should adequately function even with partial clogging. Drain outlets should be designed or located where they will not cause erosion on beaches or bluffs.

Parking areas should have at least one parking space designed and designated for access by the disabled. Where accessways are designed, improved, or specifically signed for use by people with disabilities, 1 of every 4 (25%) parking spaces should be reserved and marked for their use.

Surface slopes of parking spaces for use by people with disabilities should be the minimum possible and should not exceed 2% (1/4 inch per foot) in any direction.

Persons with mobility impairments find it difficult and sometimes impossible to use standard 8-foot-wide parking spaces. Wider spaces are needed in order for them to open doors and maneuver.

Parking spaces reserved for use by people with disabilities should be identified by signs and curb markings conforming to state regulations for access for the disabled.

DRAINAGE DEVICES, SURFACES, AND HANDRAILS

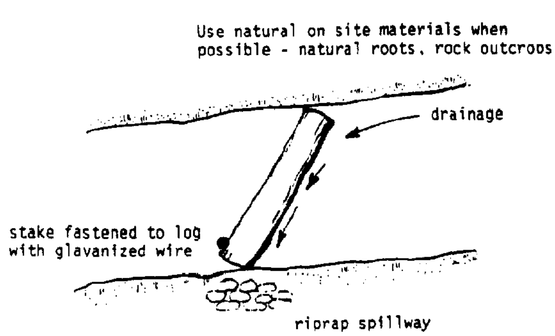
At nearly all coastal accessways, required maintenance can be reduced and accessibility improved by the installation of proper surfaces, handrails, and drainage devices such as waterbars and culverts. Recommendations for these facilities and materials are detailed in this section.

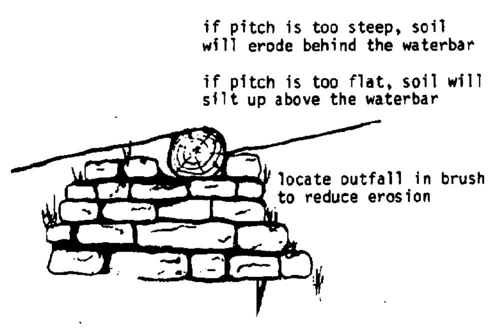
WATERBARS

Waterbars, which are used for diverting water from the trail, should be installed where it is not feasible or not sufficient to drain accessways by cross-sloping the surface. They may be constructed of rock or small-diameter logs. Although normally only required on natural-surfaced trails, waterbars may occasionally be installed on ramps or walkways. Since waterbars present barriers to people with disabilities, they should not be installed on any accessway which is otherwise accessible to the disabled.

Waterbars should be located at depressions or washes in the trail, at sharp curves set at the uphill entrance of turns, and above changes in grade. To ensure that runoff does not accumulate on a trail surface, many small waterbars are preferable to a few large ones.

The angle at which the waterbar lies across a trail is important; too great an angle, relative to the trail centerline, will cause silt build up behind the waterbar; too small an angle will cause washing away. Recommended waterbar angles are 45 to 60 degrees relative to the trail centerline. The best angle depends on the nature of the soil and trail gradient, and is best determined by local conditions and experience.



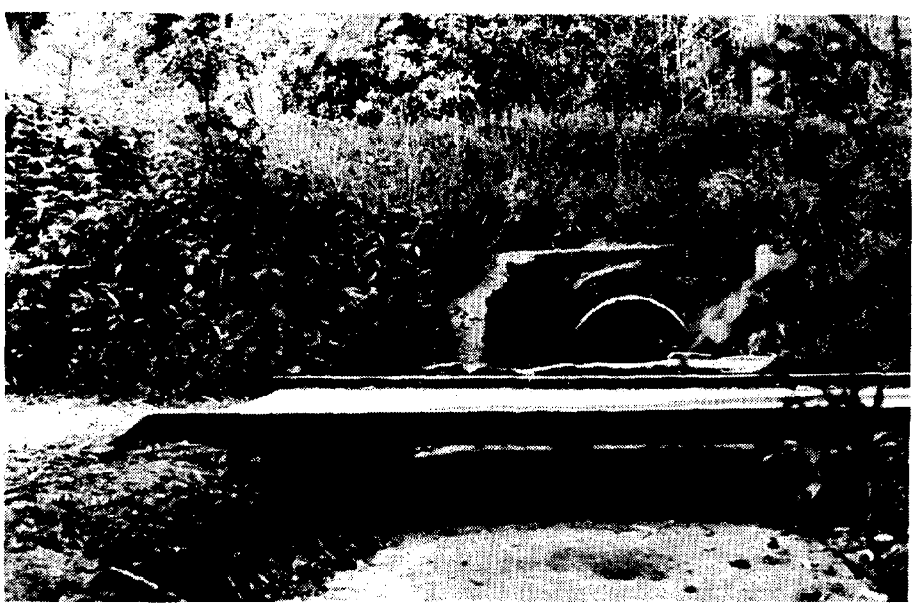


A waterbar should be backed by rocks or logs imbedded at least 6 inches deep, with surfaces kept flush with the downgrade side of the trail. These rocks and logs should extend into the bank on the upper side of the trail to prevent water from cutting around the waterbar. The outslope from the waterbar to 6 feet upgrade should be lowered to allow water to drain off the trail. On highly erodable soils, rock spillways should be constructed at the spill point adjacent to the waterbar.

CULVERTS

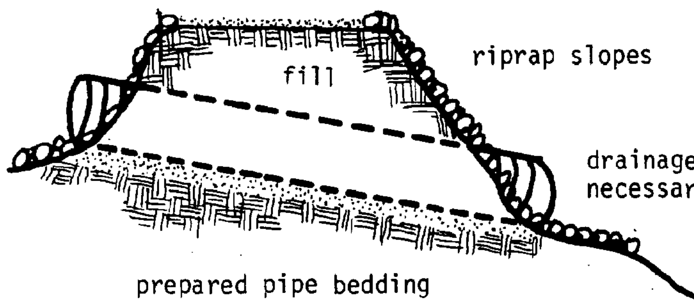
Where an accessway crosses significant natural drainages, culverts should be installed to allow water to flow unimpeded under the accessway. Culverts are also used where waterbars or other obstructions will prevent disabled access on an otherwise accessible trail. Culvert locations should be determined by established channels, and they should have a gentle slope that is great enough to prevent siltation within the culvert itself.

Culvert outlets should be built up with rock riprap to prevent scouring where water flows out of the culvert. The minimum size of any culvert should be as large as is necessary to



Six foot bridge crosses culvert outfall in Tilden Park, East Bay Regional Park District.

handle at least the volume of water predicted for a 10-year-interval flood stage for the particular drainage. Damage to trails, paths, and roads occurs when culverts are incapable of handling periodic flood high water levels, or are blocked by debris, causing runoff to build up behind a culvert and eventually flow over the accessway surface or break up a segment of the accessway. When culverts are installed along an accessway that traverses a bluff face, the culvert should extend all the way to the beach.



SURFACES

Ideally, accessway surfaces should be relatively hard and non-slip, and should reduce, not cause, runoff and erosion problems. Wherever possible, the surface should be free of breaks and potential barriers or obstructions.

Factors to consider for accessway surfaces are grip, water porosity of the material, aesthetics, erosion, installation cost, and long and short term maintenance requirements.

Permeable Surfaces

A natural-surfaced accessway is usually adequate and sometimes preferable if the facility is not heavily used and surface does not present hazardous slick conditions when wet or increase erosion problems on steep gradients.

The following are typical permeable surfaces:

Bark and Wood Chips: This material is available from pruning and thinning operations, lumber mills, or nursery outlets. It provides a natural, attractive surface which is easily laid down and prevents erosion by permitting water to drain through the trail surface. Though relatively inexpensive, it usually requires curbing to contain. Because of the loose compaction of the material, it can be a barrier to disabled people.

Gravel, Shale, or Crushed Rock: This material provides good drainage, and prevents dust and erosion problems. The loose compaction of this material can be a barrier to wheelchair access and is often difficult to walk on depending on the size of the stone or gravel.

Hard-Surfacing Materials

In areas of heavy use, steep grades, excessive erosion, or constant moisture, hard surfacing of accessways is recommended. Hard surfaces are also the most suitable surfaces for providing disabled access; they are firm, stable, and usually non-slip. However, these materials are usually the most expensive to install.

While providing access to those restricted to wheelchairs or walkers, hard surfaces may prove uncomfortable, unattractive and fatiguing to those on foot. If not maintained, cracks and potholes can render hard surfaces more hazardous than the original natural surface.

Since hard surfaces are usually impermeable, erosion can occur adjacent to the accessway where runoff drains off the path. If impermeable surfaces are installed, runoff should not be permitted to accumulate and drain down an accessway; drainage should be dispersed by providing a slight cross-slope to the path, or by installing drainage facilities.

The following are typical hard surfacing materials:

Reinforced Concrete: Concrete should be cast in place over a well-compacted and drained aggregate base. Concrete surfaces should have asphalt expansion joints approximately every 30 feet and surfaces should be brushed or lightly grooved to produce a non-skid surface.

Asphalt or Asphalt-Concrete: These materials are generally the least expensive hard surfacing materials. Sometimes asphalt and asphalt-concrete will crack or separate if poured over a base which is settling or moving. Infrequently used asphalt paving may crack and break up from vegetation penetrating the surface.

Asphalt surfaces are not recommended for accessways exposed to salt water; contact with salt water tends to accelerate decay of the material and also produces a slick surface. Cutting grooves into asphalt to create non-skid surfaces generally decreases the durability and longevity of the accessway.

Wood: Wood is normally used for surfacing of boardwalks or footbridges, or in some cases, ramps. Wood tends to be slick when wet and should not be used on accessways which are constantly exposed to water or where the surface will be steeply sloped. When constantly moist, wood surfaces decay, so wood exposed to moisture or soil should be treated with a preservative such as creosote.

However, wood is an aesthetically pleasing material. Where it is used, planks should be adequately spaced,with 1/4 to 3/4 inch gaps to provide drainage and aeration between the boards. All exposed edges should be rounded or beveled. The long direction of the grain should always be perpendicular to the direction of travel, as this reduces splintering and increases surface grip. Planks should be clear of large knots which reduce strength.

Any wood structure is vulnerable to vandalism by firewood scavengers. In areas where this may present a problem, bolts, screws, or other fasteners should be hidden, inaccessible, or designed to prevent removal.

Wherever possible, points of leverage which could be used to pry and dismantle planks should be eliminated. Construction lumber should be of a thick enough stock that it can not be easily broken or pried apart.

Where accessways are to be accessible to the disabled, surfaces should be free of barriers. Expansion joints, surface texturing and grooves, or any cracks in surfaces should also not become barriers to disabled use. Changes in surface levels greater than 1/4 inch should be beveled with a slope no greater than 50% (1:2). Changes in level greater than 1/2 inch should be ramped and comply with standards for ramps.

Trail drainage devices should also be constructed so they are not barriers. If drainage gratings are installed along an accessway, they should be placed off the center of the path. Openings in gratings should be no larger than 1/2 inch in any direction. If openings are elongated the grating should be placed with the longest direction of opening perpendicular to the direction of travel. Waterbars that drain runoff from the surface should be avoided unless they can be constructed such that they do not impede use of the accessway by wheelchair users or other disabled persons.

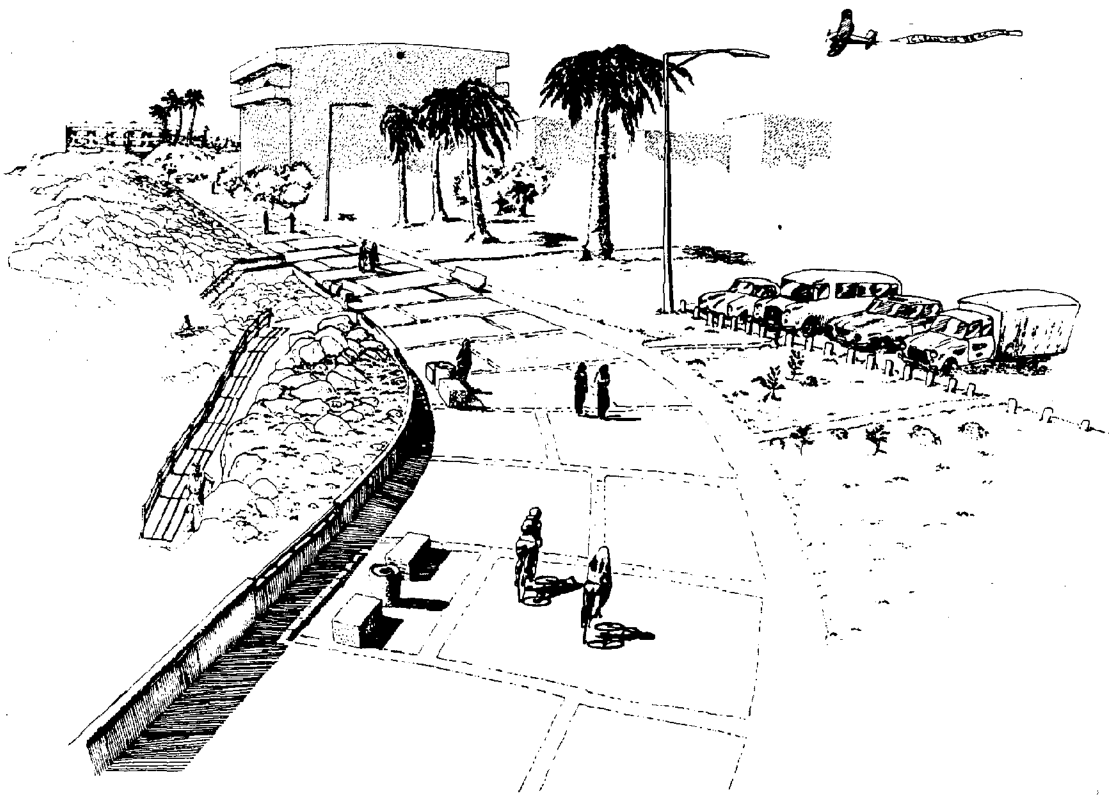
HANDRAILS

Handrails should be provided on both sides of ramps, stairs, footbridges or along any accessway which is adjacent to hazardous areas. Continuous handrails should run the length of the accessway; the inside handrail on switchback turns should always be continuous. Where ramps are not continuous, handrails should extend at least 12 inches beyond the top and bottom of the end of the ramp segment. On stairways, handrails should extend a minimum of 12 inches beyond the top nosing and 12 inches plus the tread width beyond the bottom nosing of all stair flights. At the top of stair flights, the handrail extension should be parallel to the surface of the landing or stair approach; at the bottom of the flight, the extension should continue to slope for a distance of one tread width beyond the lowest riser. The remainder of the extension, if any, should be parallel to the landing surface. Handrail height should be 30 to 34 inches above the accessway surface or the nosings of stair treads.

The ends of handrails should be shaped to facilitate grasping. They should either end in newel posts or the ends should be turned back. Where staircases or ramps change directions, handrail extensions should not protrude into the path of travel where they may create hazards or obstructions. Handrails and other objects such as telephones, lights or signs should not protrude more than 4 inches into the path of travel of an accessway. Size and spacing of handrails should comply with figure 39, American National Standards A117.0-1980.

Handrails made of split logs at Radio Road Accessway in Del Norte County.

LABOR RESOURCES



CALIFORNIA CONSERVATION CORPS

The California Conservation Corps (CCC) is a state youth work program that provides labor and assistance on public service conservation work projects. Typical CCC work projects include developing parks, clearing trails and streams, planting trees, protecting and improving wildlife areas, and constructing access areas for the disabled. The CCC also provides emergency services such as forest fire fighting and protection of areas against floods and mudslides.

The CCC will assist in projects which serve a public need and which provide valuable skills and training to Corps members. Project sponsors, which include federal, state, and local agencies and municipalities, are expected to supply technical supervision, materials, and necessary training, while the CCC provides the labor.

The assistance of the CCC can significantly reduce coastal accessway development costs. Labor costs for coastal access projects can often be as much, or even exceed, 50% of the total project cost. For these projects, the assistance of the CCC offers substantial savings. In addition, the Coastal Conservancy sometimes requires CCC participation when awarding an accessway development grant.

Some of the access projects the CCC has worked on include:

Constructing and installing redwood signs for coastal accessways;
Constructing a trail system from a regional park through the Sea Ranch community to the ocean in northern Sonoma County (the Salal Trail);
Assisting in the construction of a parking lot and accessway to Ormand Beach in Oxnard, Ventura County;
Working with the Department of Parks and Recreation to construct and install toilets and campsites;
Developing a trail and installing a bridge and toilets at Garrapata State Beach, Monterey County.

The CCC also maintains a plant nursery in Napa County. This nursery provides California native plants, at low cost, making it financially feasible to undertake needed conservation projects involving replanting. This nursery also supplies advice on types of plants which should be used, and when and how to plant them. Through the nursery, the CCC provides the opportunity to have plants properly planted by CCC members.

For more information on the CCC, contact: The Calfornia Conservation Corps, 1530 Capitol Avenue, Sacramento, California 95814. (916) 445-6330.

For information on the Corps nursery in Napa County, contact: Chris Sauer, California Conservation Corps, Napa Nursery, P.O. Box 329, Yountville, CA 94500. (707) 253-7783 or (707) 944-8832.

VOLUNTEER PARTICIPATION

Usually the greatest factor hindering the development, operation, and management of accessways is the lack of available money. Although the Coastal Commission has received hundreds of offers to dedicate accessway easements, the majority remain closed to public use because of a lack of funding to provide facilities and management. In addition, state and local parks departments and other government agencies have recently suffered severe budgetary cuts, resulting in having to reduce or eliminate operations and maintenance programs for existing recreational facilities; in some cases even threatening to close these facilities to public use.

In response to these setbacks, state and local agencies, and municipalities and public works departments should be focusing attention on the valuable role of participating with volunteer organizations in order to economically develop and manage coastal accessways. Many volunteer organizations, some of whose primary goals are to maintain beaches, already exist through the state. These organizations are sometimes affiliated with local parks or beach departments and chambers of commerce, and receive donations and support from businesses, local media, officials and nearby residents. Other volunteer organizations have been temporarily established to assist in the development of accessways. For example, the State Department of Parks and Recreation at Ano Nuevo State Reserve in San Mateo County organized volunteers from a local community college to assist in constructing a disabled accessible trail out to the elephant seals breeding grounds.

For information, assistance, ideas, examples, and contacts concerning coastal volunteer participation, the Coastal Commission and the Coastal Conservancy have prepared a joint publication, The Affordable Coast: A Citizen's Action Guide to Coastal Accessway Management. For copies, contact: The Coastal Commission, 631 Howard Street, 4th Floor, San Francisco, CA 94105, (415) 543-8555 or The Coastal Conservancy, 1330 Broadway, Oakland, CA 94612, (415) 464-1015.

SUMMARY TABLE - DESIGN GUIDELINES

	Maximum Average Gradient	Recommeded Cross-slope	Recommended Width	Surface
Trails[1]	5-10%	2-5%	3-4ft.	natural
Hard-surfaced walkways	5%	2%	4-6ft.	concrete asphalt asphalt-concrete
Ramps[2]	15%	2%	4ft.	concrete asphalt
Boardwalks[3]	5%	2%	4ft.	wood
Footbridges	NA	NA	3-4ft.	wood metal

Bikeways: Contact California Department of Transportation.

	Line of Descent	Recom-mended Cross-slope	Recom-mended Width	Riser Height	Tread Depth	Tread-to-Riser-Ratio
Staircases[4] and steps	31-64%	NA	3ft.	4-7in.	11"	64%

SPECIAL NOTES

1. Maximum Gradient: 15%
2. Ramps for wheelchair access should have gradients of less than 8.33%
3. Boardwalks with gradients of more than 5% should be designed as ramps.
4. To provide access for disabled, treads should be no less than 11" deep; risers, no greater than 7" high.

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